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PUBLIC WORKS
ENGINEERS'
YEARBOOK

1937

This Yearbook comprises the *Seventeenth Annual Proceedings* of the International Association of Public Works Officials and the *Forty-second Annual Proceedings* of the American Society of Municipal Engineers.

Public Works Engineers'



YEARBOOK



1937

Proceedings of

American Society of Municipal Engineers

International Association of
Public Works Officials



1936

PUBLIC WORKS CONGRESS

Held at

TORONTO, CANADA

Sept. 28-30, Oct. 1, 1936



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FOREWORD

IN THE fall of 1936 the American Society of Municipal Engineers and the International Association of Public Works Officials followed the precedent they had set the year before by holding again a joint annual meeting. This meeting was termed the 1936 Public Works Congress and was held at Toronto, Canada, on September 28, 29, and 30 and October 1. Responsibility for the publication of the proceedings of that meeting was assigned to the Joint Secretariat of the two organizations.

Decisions reached at that meeting, and subsequently approved by the membership, however, provided for the merging of the two societies and the formation of a new society to be called the American Public Works Association. This merger became effective on January 1, 1937, and on that date the Joint Secretariat of the American Society of Municipal Engineers and the International Association of Public Works Officials became the headquarters staff of the American Public Works Association. Accordingly, the publishers' imprint on the title page of this volume is that of the new organization. The addresses, papers and committee reports that appear in the following pages represent in substance the proceedings of the Congress.

The program of the Congress was planned to provide an orderly presentation of the more significant questions now facing those charged with public works responsibilities. In order to permit a topical arrangement for publication, however, the sequence of the material in this volume departs somewhat from the order in which the material was given discussion at the meeting.

The American Public Works Association, the American Society of Municipal Engineers, and the International Association of Public Works Officials, as organizations, are not responsible for any statements made or opinions expressed in the material herewith presented.

FRANK W. HERRING
Executive Director

March 1937

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Public Works Engineers' Yearbook, 1937

1936 PUBLIC WORKS CONGRESS

THE first session of the Public Works Congress held at the Royal York Hotel, Toronto, Ontario, Canada, convened at 9:30 A.M., Monday, September 28, 1936. Chairman William J. Galligan presided.

CHAIRMAN GALLIGAN: Will the Convention please come to order? As Chairman of the Joint Administrative Board of the American Society of Municipal Engineers and the International Association of Public Works Officials, it again becomes my pleasant duty to call the conference to order.

This year we have left the confines of the United States to gather on the friendly soil of Canada, and like a good neighbor, to bring friendly greetings to all the people of this great land. We of the United States are still confronted with many perplexing problems of government. Many men, with troubled brows, still anxiously scan the horizon, looking for some sign that will bring them the cheer of knowing that they may again enter the independent ranks of labor.

Those who are now responsible for the administration of government, I believe, are anxiously trying to bring this about, but a determined opposition now in the throes of political contest decry our present theories of government and deny its heralded accomplishments.

Across the water we find many of the important countries of Europe in the hands of dictators, and trembling nations watch with fearful eye the bitter contest now raging in Spain, lest it reach the spark that will again throw Europe into the flames and horrors of war. We, on this side of the Atlantic, still choose to use that ancient instrument given to democracies for the settlement of their differences.

And so on November 3 next the people of the United States, in the exercise of their citizenship, will march to the polls, and by the peaceful method of the ballot, there declare the will of the majority. And, whether the verdict be a continuance of the present order, or whether we are destined to follow a new star in the political firmament, this we all know, that when the drum beats will have ceased and the smoke of battle has lifted, Uncle Sam will be found with his strong, protecting arms, alike around the victors and the vanquished.

And, so I believe that these two great countries, the United States of America and the Dominion of Canada, marching hand in hand down the corridor of time, bearing aloft the torch of liberty, will light up the path and make clear the way up which all the nations of the earth, in due time, must follow.

The Administrative Board is pleased to report that the amalgamation of the two societies, so earnestly desired by many of us, is now in the offing, and that within the year it will be an accomplished fact. And so, by the strengthening of our purpose and the crossing of our blood, will come the new public

official of the future whose worth and whose accomplishments we hope will be reflected in an improved municipal government everywhere.

On behalf of the Administrative Board, too, I want to thank you for your presence here today. I know it means the foregoing of the comforts of your own homes, many to travel far afield, to be here on this occasion.

We hope that by attendance at our regular sessions and through corridor contact with your fellow members you will be amply repaid for your efforts. And now it is my privilege to present to the Conference the President of the International Association of Public Works Officials, Mr. Mark B. Owen, Dearborn, Michigan.

MR. OWEN: Mr. Chairman, Distinguished Guests, and Gentlemen: Because of the serious illness of His Worship the Mayor of Toronto, we are going to be welcomed by his worthy representative, Comptroller William J. Wadsworth.

MR. W. J. WADSWORTH: Mr. President and Gentlemen: It is my pleasure, as a member of the Board of Control, and in the unfortunate absence of His Worship, Mayor McBride, who is ill, to have this happy privilege of welcoming you to the capital city of the Province of Ontario.

On behalf of the Civic Administration and the citizens, I extend greetings and assure you of the cordiality of the welcome which is yours. We are indeed honored by the selection of Toronto as the location for this Public Works Congress, comprising as it does the 42nd Annual Conference of the American Society of Municipal Engineers and the 17th Annual Conference of the International Association of Public Works Officials.

Our citizens are noted far and wide for their hospitality to visitors who honor us with their presence, and I am sure you will experience this in abundant measure.

Toronto is ever gaining in popularity as a convention city, as evidenced by the increasing number of organizations which recognize the advantages of this municipality as a suitable place for their annual meetings. In this connection it is interesting to note that the name of the city is of Indian origin, meaning "Place of Meeting," the city in early times being a rendezvous for Indian tribes for council or warlike expeditions. It is still a place of meeting, and is being so used by many important organizations such as yours. It is a far cry from the one-time trading post to the present-day metropolis which you are visiting to-day. Those of you who have not previously visited Toronto will, I am sure, be agreeably surprised. You will find ample hotel accommodation, complete facilities for holding large or small gatherings, and unsurpassed opportunities for restful recreation and entertainment.

Toronto, in addition, has much of interest for such a Congress as yours, possessing as it does many public works projects of great magnitude. Many millions of dollars have been spent upon our harbor, which provides dockage for ocean-going vessels, and which is second to none on the Great Lakes. We are now completing a Duplicate Waterworks System which, when finished, will have cost in the neighborhood of \$14,000,000, and which will relieve Toronto, for many years to come, of any danger of an inadequate water supply. These are but two of a number of the major works that have been under construction during recent years.

I understand that the opportunity will be presented to you during the course of your convention to visit points of interest in the public works field in

Toronto. These works, which you will be facilitated in inspecting, are a credit to the efficiency and breadth of vision of our public works officials here in Toronto. Fortunate is this municipality in the possession of the services of a high type of public works official. This undoubtedly has contributed to the pre-eminent position of Toronto as a "public-ownership" city. Here the municipality owns, among many services, its transportation system, its waterworks system, its hydro-electric power system, and its extensive harbor.

The place occupied by those engaged in governmental and municipal planning of services for the people is an honorable and important one, and my sincere wish is that your convention will be attended with every success and that your deliberations in such pleasing surroundings will redound to the benefit of the many and varied governmental and municipal departments which you represent.

As a special word to those who have come from our neighboring country to the south, I wish to say that we fondly cherish the goodwill existing between our two great English-speaking nations, which have lived side by side amicably for so many generations. Reciprocation of such visits as yours not only maintains good feeling, but improves understanding and creates further links of friendship and goodwill.

In the name of the Corporation of the City of Toronto, and on behalf of its citizens, I extend a hearty welcome to you all. May each one of you enjoy yourself to the full, and carry back with you many happy recollections of your sojourn in the Queen City of Canada.

MR. OWEN: Thank you, Mr. Wadsworth, for your gracious welcome. Unfortunately George Gascoigne, President of the American Society of Municipal Engineers, is not able to be here through circumstances over which he had no control, so in his absence he has delegated Past President Harrison P. Eddy, Jr., to respond to the welcome of Mr. Wadsworth.

MR. EDDY: Mr. Chairman and Gentlemen: Mr. Wadsworth, in behalf of Mr. Gascoigne and the members of our two societies I wish to thank you for your cordial welcome. I am sure that the engineering members of our society will receive great benefit from inspecting and hearing about the big public works that you have constructed here in Toronto, and the other half of our family, the public works officials, I am sure will profit primarily and greatly by meeting the fine type of public officials you have in Canada.

Those of us from the States consider it a privilege to come to Canada to a meeting. When we think of a meeting in the old country we expect to see the acting Mayor come down with a long purple robe and a gold chain with a gold key to the city, and we have reverent respect for our common forefathers over there. But, when we come up to Canada we expect a much younger and more vigorous nation and it is more of a reunion of brothers and cousins of our own age. I hope, Mr. Comptroller, that you will express to Mayor McBride our regret at his illness and wish him Godspeed in his recovery.

Again I thank you for your cordial welcome. (Applause)

MR. OWEN: The first subject on our program is the discussion of difficult public works problems, and I am now going to turn the meeting over to Mr. Alfred E. Roche, Past President of the International Association of Public Works Officials, who is in charge of this session of the meeting.

. . . Mr. Owen retired and Mr. Roche assumed the Chair . . .

A SUMMARY OF MUNICIPAL PUBLIC WORKS PROBLEMS

PITTSBURGH, PENNSYLVANIA

William B. Shafer

MR. SHAFER: If the truth were really known, I think I express the gravest problem that faces the municipal engineer or the municipal public works official. This problem is convincing the Council we need as much money as we do to accomplish the things that have to be done. The problem that is foremost in my mind in Pittsburgh is the rehabilitation or the improvement of our dirt streets—unimproved streets. We have 1,350 miles of streets in Pittsburgh. Of those, 550 miles are unimproved, that is dirt streets. I would say we have fifty per cent of those on grades which will average from ten to fifteen and up to twenty-five per cent.

Now, all these hillsides drain to the central parts of the city in the lower areas along the river. You can imagine the flood of water that comes down those hills. These roads are dirt, and of course we have put cinders and slag on them, but there has been no attempt in the past year or two to bind them. The result is that everything comes down in a big storm to the heart of the city, washes over our main pavement, gets into the sewers and closes them up. It is a very serious problem.

Since I have had charge of the highways and sewers my big problem is to catch the water at the top of the hill as far as we can. With Mr. Palmer, who is here and who I wish would be given an opportunity to say a few words, I try to catch the water before it gets to the city, but from my standpoint I have got to do something about the roads to put a hard surface on them so that the water will wash over the top and come down clear. We can take care of the water if it is not clogging the sewers all the time.

We have a program and I have asked the Council for millions of dollars to do this up to two years ago, but of course during the depression there was no money for anything like that. However, with the PWA and the WPA, I believe we have improved about a hundred miles. Fifty per cent of that probably was penetration macadam and a seal coat added, but the other fifty miles was nothing more nor less than water bound slag macadam, and you know how long that will last. My belief is that you might as well do nothing. It gives you riding surface but the roads are rutted and torn up in a short time.

This year I am going to ask the Council to work with the WPA and contribute all of the material so that we can put a top surface on the water bound macadam after we have clarified it and made a decent contour and put in a two-inch top of premixed material. However, here is the problem that faces the Council. Under the state laws of Pennsylvania there is a very serious question as to whether the improvement of our dirt streets with hard surface pavement constitutes a permanent improvement. Well, under the statutes as they exist today, if we permanently pave a city street we never can assess the abutting property for a permanent improvement of that street. Do you see the problem that faces the Council? They say if we do put down a hard surface here we will never be able to assess this property for its just share of benefits and they hesitate very much about improving a lot of these streets that really

should be improved. Well, that involves the temporary improvement instead of the regular grading, paving and curbing. That leaves some of the better classes of streets that are still unpaved holding the bag and waiting until they can improve them with a regular grading, paving, and curbing.

We are making progress, however, and we are hoping that we can clarify the statute law next year so that we can improve some of the dirt streets and possibly let the people living along the streets contribute something toward the cost of it. Last year in order to get groundwork for some legislation in Harrisburg, I communicated with practically all of the leading states of the country to find out what their progress was. I find most states and most large cities have the privilege of assessing for semi-permanent improvement as well as for permanent improvement. It is true that a lot of them do not take advantage of that, but Mr. Byrum from Birmingham is here and I find that they have carried on a very splendid project during the last two or three years.

The people of certain communities there had expressed the desire to have their streets improved with a hard surface, a bituminous surface. The city had no money to do it but they did have the labor so the people in the community contributed to a fund, appointed a representative, and guaranteed the payment of the bills for material. While I don't know how many miles they improved that way, I do know it was quite a few. I was down there two years ago and again this year and their city is certainly presenting a very favorable impression.

I have written to Mr. Sandenburgh in Ann Arbor and find he has gotten around this problem by calling these improvements to streets a dust layer. That is carrying it a little far but that is one way of getting around it. I presented that idea to our Council but they did not think they could get away with that and that it would still be a violation of the state laws. However, Ann Arbor is doing a splendid piece of work; they are putting down the dust layers, retreated macadam of probably two inches, for as little as twenty-five or fifty cents a square yard.

I am greatly interested in talking to different engineers to ascertain how they are meeting this problem. We are going ahead and spending as much money as we can, but we are broke just as any other large city, and our permanent pavement has to be resurfaced or repaved. We have a five million dollar program on that, and so when I come along with the dirt streets I don't get very much encouragement. We are going to the legislature next year and ask for the privilege of putting in some of the semi-permanent improvements, and if possible assess the property owners for a small portion of the cost, at least for the cost of the material, and then have the privilege at a later date of assessing the property owners for the permanent improvement if it is necessary. A lot of them never will be permanently improved.

New York State has a very good plan. If they put in a semi-permanent improvement today and then want to put in a permanent improvement later, they deduct the cost of the semi-permanent improvement from the permanent improvement, which I think is a very fair basis.

ST. CATHERINES, ONT.

B. F. Lamson

MR. LAMSON: There is one matter that bothers me very greatly. It is a simple thing, but it gives us a lot of trouble, and I presume you may have the same thing to contend with. I am referring to the maintenance of such things as street name signs, traffic signs, and young trees. We seem to have a lot of mischievous young boys in our town and they will climb up those street name poles and break off the signs, bend them over, and cause a lot of destruction.

In the last few years in order to keep some of our men going we have planted a great number, several thousand, of young trees on the street. But the boys persist in destroying those trees as well as the signs. We try to give them a scare every once in a while, but it does not do much good. We are just now putting up warning notices on the poles of the street name signs offering a reward to anyone reporting these incidents.

There is another problem we have there that probably you men may have noticed if you crossed the border at Niagara Falls. St. Catherines is the next town twelve miles west. We have a very winding and twisting main thoroughfare. On the left as you came through there are a number of two- and three-story buildings with two basements. It goes right on down, and we are facing a problem of doing something to try to get the traffic to come through. I have presented a plan showing a proposed widening which, of course, would be very expensive and our Council is not disposed to advance that scheme. They did offer a counter suggestion the other night which I do not like very well and that is arcading underneath the store fronts. As the street varies in width, that arcading would vary in width, and it seems to me we would have a line of posts through a part of the sidewalk. I was just wondering if anybody had any experience with arcading a whole block and putting the sidewalks in under a part of them.

CHAIRMAN ROCHE: I wish if any of you gentlemen have had any experience on the matter Mr. Lamson referred to in connection with the construction of arcades over sidewalks and a part of your roadway, that you would get in touch with the Commissioner from St. Catherines and tell him how you solved your problem.

ITHACA, N. Y.

Harry Eustance

MR. EUSTANCE: Ithaca and a lot of the neighboring communities broke into the headlines last summer by being the seat of a disastrous flood, a position which Williamsport and Pittsburgh tried to take away from us this March. Because of this experience perhaps I can give you a little story of our observations of floods and some of the public works problems that are involved in the reconstruction.

Ithaca is a small city in central New York with a population of 21,000 and with Cornell University. It is a marvelously beautiful town. It is at the head of Cayuga Lake, and the flat downtown section and the hill section of the city are cut with four large streams. These streams contribute to the beautiful scenery, but they certainly are scenery that can destroy. The night they struck, the rain started about five o'clock in the evening with first a shower of cloudburst proportions, then a lull, and then a harder and longer lived shower. All

this was followed by a steady deluge that seemed as if it never would stop. Before dark I took a turn around the town to see the effects of all the water on clogged catch basins and some little rising streets and I witnessed a rather peculiar phenomenon. All this water had simply soaked into the ground, which was just like rubber. In the low-lying parts of the city at almost every block you would see men going around with lanterns and pails and you finally made out they had their eye on tomorrow's fishing, and were very easily picking up bait that the water had drawn out of the ground.

I went home expecting to take another turn around the town before retiring if the rain did not stop, and I got a call about ten o'clock to say that washed-out culverts had blocked one main road in the western part of town. So, I left to go there and it seemed that trouble came on all fronts simultaneously. This terrible rain kept coming and our steep hillsides poured off the deluge onto the main streets. The base of these steep hills became closed because there were a lot of loose trees that had come down with the water, and the water was carrying this debris with it. You could see it piled in mounds and the water was so deep that you could not get across. There was not a great deal you could do with the infernal rain continuing all the time in a blinding sheet.

We recruited men and trucks and put barricades around to warn the people they could not get through the streets. That act certainly marooned a lot of people who expected to get out of town back to their families and also there were hundreds of week-end travelers who could not return to the city for quite a long period.

Driving around the city with the back end of the car full of red lanterns, with a good husky helper, we came to one road at the city line and were putting lanterns at the side of a twenty-foot chasm, the bottom of which a few hours before was a road. Well, we cut across the flat lands to attend to another entrance to the road on the other side of the valley and on this road we got into water so deep that it stopped the car. We opened the door of the car here and much to my surprise the water came in around our feet and ankles. We were in three feet of water. We finally got the car back up a little grade and got it started again, but we were pretty well scared because all the water where we were meant that the center of the town was worse, and the thickly populated section was on almost as low a level as we were. We detoured around the flats, drove into the other section, and parked our car up the side of a railroad embankment, where we left the motor running and waded into the street of the low-lying section. We passed a lot of families trekking out through water over their knees, carrying their kids with bundles on their backs. By this time it is all dark and the rain is still coming down like the lights in that chandelier, and they told us there were a lot of families still on the island, as we call it, that had not been aroused. My partner and I went in there and knocked at doors and got the people out and started them wading. We found one family that this fellow knew with a widowed mother and a bunch of little kids sound asleep who had never waked up and they were all undressed. We got them up and helped them get started, letting the boys lead the mother while we carried the little girls out to the railroad embankment. The water was fairly high then and when we got out there to load them into the car to send them to the railway station to keep dry, the car stopped. The water had risen up to the

distributor. I saw the car at daybreak and all you could see was the top of it with the lights shining in the muddy water.

While on the island we waded in knee-deep water but now we waded out in water up to our chest and it was still raining. Coming towards you in the dark floating with the current were trees, barrels, and lots of other things, and if some of that stuff had struck the people wading out they might have been knocked off their feet.

The railroad station was a refugee station and this too had a foot of water flowing through the doors. The kids were curled up on the benches, soaking wet, but they were covered with blankets from a work train.

The whole area of the central part of the city was under water, as could be seen at daybreak, and it was still raining. The hundred-foot inlet was two miles wide. The streets paralleling the inlet were flowing so deep that they could not be crossed with high-wheeled heavy fire trucks and in the rest of the town one creek stayed within its banks but the other two were over and doing their share of the destruction.

Shortly after six o'clock the deluge had its first let-up. From five o'clock of the night before until six o'clock in the morning we had over seven and one-half inches of rain, and in the whole day over nine inches. One creek had a previous flood discharge of 9,000 ft., but it was roaring down the gorge and over the flats with 25,000, which was almost three times any previously recorded flood.

When the rain did stop and the creeks got back in some control the damage could be surveyed. About a thousand homes had flood damage of some sort to cellars and first floors. In the county fifty bridges were almost washed out. We have eleven state highways entering the city but only two of them were available to traffic for days and we had considerable debris to clear away. There were dead animals to be picked up and disposed of; cows all bloated up and floating along, and we had to dig out a lot of cars which were buried under trees and dirt. Water mains were broken so that the water had to be shut off, and sewers were washed out, grades of roads instead of being down the slope as in Pittsburgh, were covered with nine or ten feet of debris.

To start the clean-up we got all of the available labor we could, and there was a scrap on as to who was going to get the men and equipment, but the first job was to take care of the water supply and sewers and get the main roads opened. Then came the long, difficult, and expensive task of fixing up the creeks that had in some places discharged thousands of yards of gravel that had to be removed.

This flood business is a very important municipal problem where creeks or streams exist to menace cities. I hope this decade will see adequate flood control for American cities. We think it is on the way as army surveyors have prepared plans for the detention and preservation of channel improvements, and in Binghampton there is a dam under construction now. It is a very important municipal problem.

BIRMINGHAM, ALA.

George Byrum

MR. BYRUM: Mr. Chairman and Gentlemen: It seems to me that all of our problems are similar. We have a lot to do and don't have enough money

to do it with. In Birmingham this year we had two problems that come to mind that might be interesting and that we all might face at some time or other.

The first thing that happened was that our mechanical cleaning equipment died a natural and honorable death due to a very advanced state of age, and we had to revert to hand-cleaning methods. Now in my mind that is a little unusual because as a rule we go forward each year and now it was necessary to revert to the old hand-cleaning method. We have an area of about fifty-two square miles for a population of around 260,000 people. We worked that out very well and it will take care of itself for a few months to come.

The other problem we had in Alabama was that we had eleven inches of snow one night. That was terrible. We have some very peculiar snows down there. It may spit snow for a little while, the ground may get white, and in a few minutes it looks as though you are going to have to do something about it. Then the weather changes and within thirty minutes it is all gone. Then the wind may change and it may freeze up, and by the time you get your cinder trucks started on the way the weather changes again and it is all slush and disappears, and then it may snow a little again and when the trucks get back you may be confronted with the same thing again, and so you don't know what to do.

Well, it started snowing about seven o'clock one morning and it went through that process of putting just enough on the ground to whiten it and then it would melt away, but about five o'clock in the afternoon it set in rather heavily. The thermometer was not low, however, and we did not think much of it. I did not sleep very well because I had to watch it and ride around in it, for it was an experience to us and I was having a big time taking in the whole city and keeping my eyes open. Well, it did not stop and it snowed all night. The next morning we had eleven inches of snow on the streets in Birmingham. I think one or two street car lines were running and you couldn't buy a tire chain anyplace. I think each automobile supply house at the beginning of the fall season put in two chains for each tire sold in Birmingham. Anyway, a few taxis did have chains and people were able to get to work sometime later in the morning. For the snows we had had before we usually depended on warm weather the next day, with the sun coming out and doing our job for us. Well, we waited until about ten or eleven o'clock for the sun to come out, but we had taken all of our hand forces and cleaned off the sidewalk area in the immediate downtown section. The property owners were supposed to do that but I don't think they knew it although the ordinance had been on the books for about thirty or forty years, and this was the first time they had to clean the sidewalks. So we had to clean off the sidewalks and dump the snow into the gutter.

In the middle of the day, instead of the snow melting, the sun came out and slicked it up a little bit and it froze again, and so later in the afternoon we sent out frantic calls to all heavy equipment companies in town to try to borrow some equipment to move the snow. We finally opened up three or four highways and took care of the through traffic, making it possible for people to get down town. Then we put all of our grading equipment on the car tracks, opening them up. Then we thought surely that nature would take care of the snow the next day, but it did not and it was still piled up

on the streets that afternoon, and we suddenly realized that we would have to get rid of it some way. So, the Commissioner authorized me to broadcast an appeal for labor to shovel the snow off the streets of Birmingham. That was five or six o'clock in the afternoon. I got in touch with one of the radio stations and told them to give us 250 men at a certain point at eight o'clock. Well, we had 1,500 men standing in line willing to shovel snow that night.

There were one or two very curious but pitiful things noticeable and that was of those men who came down there to shovel snow several were using automobile truck inner tubes to cover their feet. They would cut the inner tube and put their foot into it and then pull up the other end and wrap it around their leg. Well, we put them to work for about eight hours and got most of the snow off the down town streets and what was left would not hurt anything.

There is one problem we were not very well able to solve. The snow in heavily trafficked places had ruts and when the cars would get into them they would get stuck and there was nothing to do but to get ten or fifteen people to help push them through. We put our graders on them and could not move them and we finally had to put men in there with picks and shovels. Of course, I imagine that in cities where you have a regular snow-fall you remove the snow before it has a chance to get packed and rutted in car lines. I would like somebody to tell me how they meet such a situation.

That is the only thing we had that we could not handle. If any of you gentlemen here will enlighten me on how you avoid those ruts on track crossings, I would be delighted to hear from you.

CHAIRMAN ROCHE: I am glad to know of one way to stick our friend from Alabama and that is by sending him an eleven-inch snow storm, but I believe he will handle it more efficiently the next time. However, should he not be able to do that there is a gentleman in the room who can tell him how it can be done. I am going to ask Mr. George M. Shepard of St. Paul to tell us if he has ever had a snow storm.

ST. PAUL, MINN.

George M. Shepard

MR. SHEPARD: Mr. Chairman and Gentlemen: In spite of all the advertising we have had up in our part of the country, St. Paul and our sister city Minneapolis, we are still going along all right. I am going to confine my remarks mainly to street maintenance and I will touch on the snow matter a little later.

Mr. Shafer of Pittsburgh stole quite a little of my thunder in the dirt street matter. I had quite a complete statement prepared and I am going to cut it short. However, you will agree with me that your problem in public works is very much the number of people who live along the improvement you are concerned with. About half our streets are dirt, unpaved, but improved in some fashion, and our charter provides that we may sprinkle improved streets. Some years ago a progressive city attorney, prompted by the interested public works officials in St. Paul, ruled that we could sprinkle these streets with oil provided that such sprinkling reduced the dust nuisance. That has been done for a number of years, the method being to tear up the street completely from end to end every two years, and sometimes every year if

necessary, and to oil the streets thoroughly. However, due to a drastic cut in street maintenance funds, we were considerably handicapped. Incidentally, the cost of the oiling was assessed and the financing was paid from the street maintenance fund.

In 1933, due to the drastic cut in our street maintenance fund, we sought other means of taking care of the streets. We bought two heavy disks to try to disk off the rough spots, move the loose material, and replace it with a shot of road oil, a very small quantity of one-tenth gallon per square yard. We did this and in some cases put on a seal coat of road oil, sand, or road chips, and it seemed to work all right. The first year some holes appeared in the street and they were filled with a cold patch material manufactured at our asphalt plant. The result has been very satisfactory and what was begun merely as a means of getting by developed into a permanent part of our street improvement program.

The matter of pavement maintenance is an important one. Our new pavement requires very little maintenance. The old pavements, and particularly the old asphalt and other pavements constructed on the old base or the natural cement base, require quite a lot of repair. We plan to repave all these streets, but because of inability to assess the cost we have had to give this up and do the best we can by putting a retreated process on the old cracked asphalt pavement. The creosote block surfacing, of which we have about 600,000 yds., still remains and nothing has been done since 1933, but it is quite a problem. We are able to continue these in service by oiling them each year and replacing only those areas that bulge up or float away during a heavy storm.

In the matter of snow plowing and removal, it is necessary for us to organize quite thoroughly. The summer street maintenance crews and the municipal equipment are used as a nucleus for snow plowing and snow removal. The city is mapped out in routes. The plows consist of several types of equipment, the straight-edge-blade plows which are mounted on trucks, oil distributors, or even sprinklers. We have motor patrols and plows mounted on tractors or on four-wheel drive trucks. The four-wheel drive trucks give greater speed on the outlying streets. In all we have forty or fifty pieces of equipment which are kept ready and are operated from a central dispatching center. The plows are sent out in tandem or even in threes. This results in more thorough work and in case of a breakdown is very helpful.

Now, in regard to the question of the removal of snow in the downtown district. That is done by loading equipment or by hand loading. After the snow is brought to the gutter the loading equipment passes along and picks it up. I see that human nature is much the same in Alabama as it is in St. Paul, for while our ordinance requires the private individual to shovel the sidewalks it is very difficult to enforce. We find after going through and cleaning off the streets and the gutters that the next morning after the walks are cleaned an additional pile has accumulated which all has to be cleaned out by hand.

Also, we find in cleaning the snow we have considerable difficulty with parked cars. An ordinance which requires all cars off the streets between ten o'clock in the evening until six o'clock the next morning is very rigidly enforced in the winter season. The problem of ruts troubles us in St. Paul.

In our climate generally, when the snowfall is preceded by a rain or by the heavy snow in the early stages of the fall, it leaves a thickness of snow which is difficult to remove or blade when it freezes soon afterwards. We have combatted the ruts by using motor patrols with teeth which run back and forth loosening up the heavily packed snow and pushing the material to the side, from where it is loaded into trucks by hand. However, some of it cannot be removed that way. For instance, the entrances to the catch basins have to be removed by hand and that is a job in the spring.

ATLANTA, GA.

Henry Cates

MR. CATES: Mr. Chairman and Gentlemen: Since this discussion began I have been trying to think of something in Atlanta connected with sanitation and the sanitary department that is not a problem. Some six years ago they elected a Mayor down there who took office with a million and a half dollars deficit and he was determined, it seemed, not to allow that deficit to increase one dollar. I remarked to him on several occasions that I did not think it was necessary to take all of this money out of the Sanitary Department. When he took office in 1930 and the smoke cleared up, we were short eleven garbage trucks, leaving us forty-five garbage trucks and no street cleaning equipment. Ten mechanical brooms were placed in the shed and we were confronted with the problem of removing garbage with forty-five trucks when we had been using fifty-six. And we had to keep six hundred miles of paved streets clean with the two brooms that were left.

To overcome this problem, we arranged our method of garbage collection by putting two trucks together with all the labor, and while one truck was on its way to the incinerator the same crew was loading the other truck. This gave us an extra load a day per truck and that handled the garbage situation fairly well.

Then, we were faced with cleaning the streets. We had gained some little time on garbage collection and the only method we had then was to pile or sweep street debris to the side and let the garbage trucks pick it up and carry it to the incinerator, and that brought on another problem. We had a considerable amount of dirt to contend with at the incinerator. An analysis of that refuse over a year showed that twenty-five per cent of all the stuff we haul was passing through the half-inch mesh screen. I would like to say that at our incinerator, which is a steam generating station or plant, we have a contract with the utility company to utilize our excess steam which amounts to something like \$200,000, and through the sale of the steam we are able to save eight per cent on that investment. That helped immensely.

We have a mixed collection, with no separation of any kind. We went into a very thorough analysis to see what refuse was being received and what it was made of. I am sorry that I do not have that information with me because I think you would find it quite interesting. However, the main problem we ran into was the dirt, and to offset that we are at this time installing a screening plant with a magnetic separator and hammermill which we feel sure will clear up all of our trouble.

Mr. Byrum told you that his trouble was with snow. We had it worse

than that. We had eight inches of snow, but we also had a sleet. It started raining late in the afternoon with a slow drizzle. Then it began to freeze and by the next morning all traffic on a large number of thoroughfares was stopped with tree limbs. We were faced with the problem not only of removing the snow, which we did not bother much with, but removing all the limbs of the trees. We had never been faced with a problem of that kind before and we certainly hope that we will not be faced with it in the future.

CHAIRMAN ROCHE: I am sure Mr. Cates of Atlanta spoke of one novel feature of a municipal program that none of us has ever experienced. I refer to that portion of his remarks concerning the deletion of funds of public works undertaken by the executives of the municipal government. I don't believe any of us have ever seen an executive pick on the Department of Public Works for economizing, as they always go outside to education, recreation, or health. It is very interesting to know that the public works in Atlanta should suffer in such a way.

Next we are going to hear from Mr. E. F. Martin from Montclair, N. J.

MONTCLAIR, N. J.

E. F. Martin

MR. MARTIN: Mr. Chairman and members of the Public Works Congress: I have been asked to discuss my headaches. Well, my most serious problem has been that of street maintenance and snow removal. While I realize in the past few years it has been essential to economize in all governmental agencies as well as in private industries, nevertheless I know of no way of preventing the deterioration of pavement unless ample funds are provided for that purpose. I believe to economize in street maintenance is always false economy, and I should like to emphasize this fact to the officials elected to govern that municipality.

During some administrations it becomes necessary to appropriate additional funds, and I would like to cite this: We had an election in May and four commissioners were elected with the courage and foresight to appropriate \$50,000. Now, what does that do? It creates a bonded indebtedness which would have been avoided if the past governing body had had ample foresight. I would like to cite this: Previous to 1932 in our municipality approximately \$50,000 was appropriated for street maintenance and in 1932-33-34 and 35 only \$12,000 was appropriated, which is less than twenty-five per cent. These gentlemen recently elected had the courage and foresight to see that need and they immediately appropriated additional funds.

Now, in regard to snow removal. To me that is in the same category as street maintenance. I would like to cite this as an example. From 1932 to date about \$5,000 was appropriated in Montclair for snow removal. This year \$10,000 was appropriated in the beginning, and before the budget was adopted I had spent \$15,000. Now then, what happens? The Board of Commissioners made emergency appropriations one after another amounting in all to \$15,000, which amount will be put in next year's budget. In other words next year's budget will be short \$15,000 before we start.

I would like to say just a few words about sanitary sewers and infiltration. I believe Mr. Eddy will bear me out when I say that some of our trouble is due to sewers that were constructed twenty-five or fifty years ago, and

that a lot of infiltration, coming through foundations during a rain storm or immediately afterwards, would not do so if the trap in the cellar or the clean-out were some six to twelve inches higher than the basins. From my own observations I find that where ground water seepage is coming through the foundation there are grooves all around the foundation leading to this trap. I believe if the officials would enforce that order they would save themselves considerable trouble.

ALBANY, N. Y.

Lester Herzog

MR. HERZOG: I just want to say a few words about organizations, and such an organization as we have here. I recall when I was appointed Commissioner of Public Works—and it is not twenty-five years ago as it was along about 1922. I was formerly a banker and had gone into business for myself. I happened to be elected Alderman from a ward that was very strong the other way from the party to which I belonged, but I was elected by a few votes and was requested to take the position of Commissioner of Public Works. I don't want to make any disparaging remarks about engineers, but I told the Mayor that I was not an engineer and so why would he want to appoint me. He said, "We have all the engineers we want in the public works department and we now want a business man," and so I took the job. You can naturally understand I did not know what it was all about.

A couple of months afterwards I received a copy of the minutes of the Sanitation Officials with a request that I might be considered as a member. On reading that over I thought, this is just what I want and what I have been looking for. So, I went to Chicago to their next meeting and joined the Association. I think I had a fairly successful six years as Commissioner of Public Works and I put a great deal of stress on the fact that it was the information and knowledge I got at these meetings that helped me so much. Our association at that time was small and we were more like the tail of the road show than anything else, but we did get twenty-five or thirty men at our meetings. We sat around a table and Bill Galligan was President, and every man was called upon to speak. Imagine how long we would be here now if everybody was called upon, but at that time every man had to discuss every problem that came up.

For instance, if snow removal was discussed, every man at the table had to express his opinion and tell us what he was doing in his city. The same thing was true with the cleaning of streets and garbage disposal, and with a small membership we could cover a great deal of ground.

I recall particularly one thing that was told to me at one of those meetings. One of the men, talking of snow removal, said they watched the newspapers and whenever a death occurred they sent a truck around to clean the snow from in front of that house. That was something new to me, but when I got back to Albany I put that into effect and it was one of the most popular things I ever did as Commissioner of Public Works. We were serving them at a time of distress when we removed that snow. I met a gentleman one day and he said, "I want to make you a present; I want to give you a Thirty-Third Degree charm that belonged to my father-in-law." I said, "What do you want to give it to me for?" And he said, "My wife just died and I

hired some men to clean the snow from in front of my house and your men came around and ordered them away and said that that was the city's job. I don't know whether you did that because you knew me or not, but I want to give you this charm in appreciation of that service." I said we did not do it because we knew him but that we did it for everybody in the same circumstances.

It is those little odds and ends that I picked up at these meetings that enabled us to have a pretty good Department of Public Works. I believe this new organization of ours, if ratified, is going to make that much stronger, particularly for the city officials. And, instead of from twenty-five we will draw men from hundreds of cities and get experiences just as we are getting them here today.

I just want to say one more word which may be a little off the program and that is a word of counsel about the federal activity in works programs. I want to put this thought in your mind: There is a great deal of criticism and a great deal of praise for it, but you are going to get out of that program just what you put into it.

ARDMORE, PA.

Walter E. Rosengarten

MR. ROSENGARTEN: Lower Merion Township is just west of Philadelphia. It is a beautiful suburb of about 30,000 population. Fortunately, it is without debt, which probably is one of the reasons we do not have some of the serious problems of other communities. We have a few steep grades but not a great many. We do have storms but not such disastrous ones as the one in Ithaca. We get snow, but we expect it, and so far that has not been a problem to us.

So, in casting about for a real problem, I believe the one that I might mention this morning is trying to fit our highways to present-day traffic. I am speaking about the highways that were laid out in the old horse and buggy days. Many of our roads were opened fifty, one hundred, and two hundred years ago, and I will take my hat off to our forefathers who opened roads thirty-three to forty feet in width which would be used by an occasional horse and buggy or a man on horseback, when there were just a few scattered people in a rolling country. Today you all know the conditions that have developed in the last twenty-five years, with the millions of automobiles and the requirements of taking care of present-day traffic.

Today when we mention in the community the opening of a road of, say, fifty feet right-of-way width or greater, most everyone throws up his hands and says we are unnecessarily condemning property or asking for more than is really needed. Yet, you all know that we could utilize the entire width of that right of way for actual vehicular traffic and not have any too much space.

So, in an older community such as the suburbs surrounding Philadelphia, the width of the right of way has been a real problem. And, along with that is the problem of planning so that a new road to be opened will be of sufficient width for the future and yet not permit the development of bad conditions such as certain dead ends or areas that cannot very well be opened as development proceeds in smaller subdivisions of property. Those are conditions which, if permitted to develop, will lead to slum areas in the community.

To some extent we have taken care of the problem by the passage of an

ordinance which now requires all developers to submit their plan and obtain a permit before any road is opened or constructed. That has assisted materially in getting wider right of way, but it has progressed very slowly. About our only solution has been picking up here and there, by dedication, pieces of additional right of way, especially at tight places. We had one example a year ago where the dividing line between Philadelphia and Lower Merion Township was improved to a fifty-foot width which was the entire right-of-way width. Years before, a fifty-foot right of way had been plotted but never required, and through the generosity of the property owners we were able to make agreements of dedication with almost every owner along that entire three-mile strip. They all dedicated an additional fifteen feet, and in return for that the Township built sidewalks, planted trees, and put in retaining walls where necessary. In other words, we improved the property or at least put it back into as good condition as it was before.

There are a number of other problems that have arisen, but time does not permit my telling you about them, and so I shall leave with you the thought that our most serious problem seems to be that of obtaining the right of way necessary for present-day traffic.

ROCHESTER, N. Y.

M. D. Hayes and Thos. J. Morrison

MR. HAYES: Mr. Chairman and Gentlemen: I don't feel I am the right one to talk about this problem as there are a number of my colleagues here from Rochester who have been there a much longer time than I have and they have been wrestling with the problems for many years.

Last week we had a conference with the army engineers on the question of flood control in the Genesee Valley. That river, as you know, empties into Lake Ontario and the drainage area runs down nearly to the Pennsylvania state line. Rochester's problem in connection with that is to maintain a channel so that the water that comes down from that section can get through without damage. Mr. Fisher, our consulting engineer, is here this morning and he has written a two or three hundred word pamphlet on the flood control situation which is going to be printed and which will also touch on some of the areas outside.

MR. MORRISON: Mr. Chairman, and Gentlemen: I believe that we have one problem in Rochester that Mr. Hayes knows all about but did not mention. We are troubled with the fact that we have only one main street. It is probably the most serious problem we have. The layout of downtown Rochester is such that all the business, or almost all of the business, is transacted on that one street. That is Main Street, running approximately east and west. To the north and south of it there are short streets that begin nowhere and end nowhere. Our problem is not the solution of the thing but where we are going to get the money to carry it out. We have very definite plans, but to put them into execution, with men qualified to handle it, would mean the expenditure of about twelve million dollars. We can hardly do it under a PWA project because, of those twelve million dollars' expenditure, about six or nine million dollars would have to be for land. So, our problem is where to raise the money and how to assess it.

We have been struggling with that for years and we have it with us

today. We hope to be able to solve it sometime but we don't know of any immediate way to raise the money. That, Mr. Chairman, is about our chief problem. Now, if anybody here can help us to raise that twelve million dollars, we hope that he will speak up.

CHICAGO, ILL.

W. W. DeBerard

MR. DEBARARD: I am not exactly prepared to tell you how to raise twelve million dollars. However, the funds for improving Michigan Avenue in Chicago were raised by special assessments a long time before the present depression started in on us. There was a certain amount of money collected through bond issues, but not more than five or ten million dollars and it was spread over a very large area. Of course, in Chicago you have a large area to spread it over. The bond issue was a comparatively small amount and, as I recall, it was only about thirty per cent of the total amount. The balance was charged to the abutting property owners and then spread back from them.

After the work had been completed, the planning commission said that the value of the property was increased in the amount of the assessment, and that it had more than paid for the investment, or that it would do so over a period of time. I have my doubts as to the exact validity of that argument, but I think perhaps the spreading on the immediately adjoining property probably will bear out that statement. However, when you get back of Michigan Avenue a block or two blocks to the west, you certainly get into the areas which are somewhat depressed in value, and we have a condition back three or four blocks which is blighted; perhaps not slums, but nearly so.

We are confronted with a very serious problem in trying to decide what to do with the slum areas. There is a ring around the Loop of Chicago which is in the same condition as I presume you have in Rochester off your Main Street. It is just twelve million dollars you desire to utilize in the opening of the core of the city, so that you can get this low table area back on the tax rolls with people paying their just share of improvements and services. It is that problem which we have in Chicago, and it would take an immense amount of money to do it.

We have a lot of problems and I could tell you about one of the PWA men last week who was talking about \$55,000,000 to build a highway from the center of the Loop in Chicago directly west. Some other people have figured that that would cost \$150,000,000, so we are not worried about six figures in Chicago when it comes to street improvements and opening up blighted areas. Where we are going to get the money God only knows, and if you find out in Rochester we will come over and ask you how it was done.

DEARBORN, MICH.

F. R. Storrer

MR. STORRER: Mr. Roche, Gentlemen: I have been listening with pleasure to some of these problems because you talk about snowstorms and windstorms and floods. I can sit at home and laugh at them unless they happen to come by my doorstep, because I am primarily interested in the design of public works rather than in carrying them out or maintaining them, and it is a great relief to know that I don't have the problems you do.

I represent a city of about 65,000, just about the size when you are ready to accomplish big things but have to depend upon your present personnel to accomplish it. Consequently, when we get requests for buildings, parks, recreational centers, and everything from barns to community centers or municipal power plants, it is quite a problem to turn that out with a small staff. Sometime ago I happened to notice in a magazine that an expert is a guy from another town, so I gave that little clipping to one of the boys and told him to make a little sign big enough to be seen under the glass of my desk without glasses. Since that has been there, there has been a considerable difference. Now instead of the consulting engineer being the expert it is the city engineer. That little sign seems to have turned the tide and I think I will have to take it from under my glass.

In our city the problems are so many and so diversified that unless I referred to some of the magazines and their indexes, such as the *American City*, I would be stumped. I have departed from that part of the program about solving your problems because I have not solved mine yet. The best method I know is to go through the different magazines you subscribe to with a fine-tooth comb. Do that when they first appear on your desk, or at least before you put them away. Make a thorough index and the chances are you may index something about the installation of a power plant in California which will be a real help if you have to design one later. You may find out in four or five years that some of the articles you indexed are the clue to where you can get the information that will permit you to solve your problem. At least, I have found that to be the case.

SCARSDALE, N. Y.

Arthur Boniface

MR. BONIFACE: Mr. Chairman and Gentlemen: I am just going to give you one little illustration. I always feel that any city official is there to do what he can for the benefit of his people. One morning I was called up and it was a very embarrassed young lady who said, "I don't know how to approach you, and I don't know what official to go to except to you. My daughter has lost her engagement ring which cost quite a little money." She evidently had dropped it into the toilet and it went down into the sewer. Well, all you could tell her was not to pull the chain any more. Without going into detail, we recovered the diamond ring at the manhole next door. That is just a little public service and that is just one of our problems.

We have never had any difficulty financing things in our village and that is true even for snow removal. If we don't have enough money we appropriate it on a certificate and go through with it. But, it is the solution of the intimate problem which brings success to any community, large or small. There is no detail so slight that you should not give it your wholehearted attention.

When I was the mayor of our city I had long advocated that a city government was nothing more nor less than a business administration and should be conducted as such. Well, at the end of my term they insisted that I stay for a while and act as city manager. I consented for one year, but unfortunately it has gone on now for fifteen years. However, during all that time my one thought always—and I can't emphasize it too strongly—is simply to pay attention to details and the rest will take care of itself.

EFFECTIVE OPERATION OF STREET SANITATION SERVICES

(A PANEL DISCUSSION)

THE sixth session of the Public Works Congress held in Toronto, Ontario, Canada, convened at 3:00 P.M., Wednesday, September 28, 1936. Mr. Mark B. Owen presided.

CHAIRMAN OWEN: Will the meeting please come to order? I would like to say a few words about conducting this type of a panel discussion as this is the first time it has ever been tried in this organization.

We have selected a list of topics for discussion by members of the panel. The audience takes no part until the discussion is finally concluded and then the highlights of the discussion will be summarized as the conclusion of the discussion by Mr. Kendall.

Perhaps I should at this time introduce the members of the panel. They are Robert L. Anderson, Winnetka, Ill., J. A. Burnett, Toronto, Ont., George Byrum, Birmingham, Ala., H. J. Cates, Atlanta, Ga., and J. Eugene Root, Cincinnati, Ohio.

After the panel has concluded its discussion the meeting will be thrown open for general discussion by the members. The topics we will try to cover have to do with street cleaning, catch basins, sewer cleaning, enforcement of sanitary regulations, etc. I hope that we can cover these subjects so that they will not be disconnected, and one subject will lead into the next.

Mr. Burnett, what are the various types of equipment you are using in the street cleaning work in Toronto?

MR. BURNETT: The method for cleaning in Toronto is by broom, a scraper and a push cart; that is, a tub or metal can which is attached to a two-wheeled cart. The material is swept and placed into small piles.

CHAIRMAN OWEN: What sort of equipment do you use in Winnetka?

MR. ANDERSON: Winnetka is a small city with a large mileage of residential streets and we find that a motor pick-up sweeper handles our problem the best, with, of course, hand cleaning where necessary.

CHAIRMAN OWEN: Do you have beat patrols?

MR. ANDERSON: No, but we have a regular hand clean-up, particularly in the business district.

CHAIRMAN OWEN: Do you find that beat patrols are the best way of solving the street cleaning problem in the business district? What has been your experience?

MR. BYRUM: In the heavy business district of Birmingham during the day-time we use beat patrols, or white-wings with push carts, shovels, and brooms. We have built a system in Birmingham of placing a sack into the can which can be taken out and replaced with another. They are just ordinary feed sacks that you can get anywhere in town. Each man goes out in the morning with enough sacks to take care of his entire load. Those sacks, when filled, are put in designated locations and the truck comes along and picks them up.

We have a group of citizens who have very little respect for the cleanliness of the city and after the white-wings' work is completed—they work on an eight-hour shift—we have a dead spot from four o'clock in the afternoon until

eight or eight-thirty at night, and then it is necessary to give the whole downtown area a thorough cleaning to get it ready for the next morning. Up until three or four months ago we used the Elgin sweeper but it died an honorable death at the age of sixteen or seventeen years, so, temporarily, it is out of the picture and we have to depend on hand crews which are composed of negroes—convict labor. Of course, that is a condition that you all do not have. We can send five or six negro convicts out on a truck with a driver who acts as a guard, a foreman and a driver, and he turns these negro laborers loose. They are pretty good, and we never lose any of them, and they do their job every night.

Then, of course, we sometimes use a flusher, which precedes the hand crews, depending on the circumstances, and then again we route them all over the area during the night and let them follow us. That is the plan we use in the immediate downtown area where it is heavy.

CHAIRMAN OWEN: Do I understand the burlap bags are burned or reused?

MR. BYRUM: We have storage places. We picked out dead spots and got permission from the property owners to build racks with gates on them. We had to do that to keep persons coming through the alley from taking the sacks and selling them. The driver has a key and he empties the sack in a dump truck and replaces the sack in the bin or shed, locks it up, and goes on. Of course the white-wing picks up his empty sacks the next morning.

CHAIRMAN OWEN: Do you find you can clean the downtown streets in Atlanta by machine sweepers or do you have to depend on beat patrol?

MR. CATES: The downtown streets in Atlanta are washed every night. During the daytime we patrol with white-wings and a little push cart. We also use two sweeping machines at night for our main thoroughfares.

CHAIRMAN OWEN: What about the parked automobiles at night? What effect do they have on your cleaning?

MR. CATES: There has been no method devised as yet to clean the streets under an automobile. The best we can do is to wash it and let it go at that.

CHAIRMAN OWEN: How do you handle that in Toronto?

MR. BURNETT: This year we started night flushing and we find that parked cars do not interfere to any appreciable extent with the efficiency of our work. We have for many years past operated flushers in the daytime, but this year we have had a great measure of success with night work.

CHAIRMAN OWEN: Do you have any regulations regarding the parking of automobiles?

MR. BURNETT: We have certain restricted areas and the parking is limited to certain hours. The restrictions are principally in the downtown district and main streets.

CHAIRMAN OWEN: I understood you to say, Mr. Byrum, you clean the downtown twice. Are you troubled with parked cars?

MR. BYRUM: Very much so. One time I experienced so much trouble that I dug out the ordinance and had notices printed and put them up, but I got orders from the Commissioner next day to take them down. I think it is a nuisance and know no way to control it.

CHAIRMAN OWEN: How do they handle the parked automobile problem in Cincinnati?

MR. ROOT: At the present time our men have to put up with any cars on the street.

CHAIRMAN OWEN: Is there any attempt made to put a ticket on a parked car in a restricted area by either your street cleaning crews or is it reported by them? Has that ever been tried?

MR. ROOT: In Cincinnati they have controlled parking or at least have attempted to control it. Of course, the parking regulations come under the Utility Department in Cincinnati and are subject to the approval of the City Manager. If there is restricted parking in a certain street in the downtown area of fifteen minutes between the hours of nine and four-thirty in the evening, that limited parking is controlled by the Police Department. After six in the afternoon there are no restrictions as to all-night parking. If you want to come downtown and visit in that area, you can park all night. If you get a ticket to go to court, the court just excuses you or at least you are not fined. When a revised traffic code was put into effect it took out the downtown restrictions of two A.M. parking. If there were two cars on the street you were prevented from cleaning that area. I endeavored to get all parking prohibited in the downtown area after two A.M. but that was not possible through our City Council. I don't think it is any more of an evil to have it out of the code than it was when it was in. There are not any more people parking after two A.M. now than there were when that provision was in the ordinance.

CHAIRMAN OWEN: What time do your crews go out to the business district?

MR. ROOT: Our crews leave the central station at ten o'clock in the evening and they work the main thoroughfares between their central stations and then work the downtown area until six o'clock in the morning.

CHAIRMAN OWEN: What hours do you clean your business district?

MR. ANDERSON: From midnight until six o'clock in the morning. The parked car problem is also prevalent there although we have had good cooperation from our Police Department in attempting at least to enforce our regulations on that subject, and it is probably about seventy-five per cent effective, I should say. Inasmuch as we have a rather small and less intensively used business district than is the case of some of the larger cities, the cleaning is not necessary every night. We clean it every other night regularly the year around, but we find that in case we do have to go around a car and miss a section the hand crew can easily pick it up, or if it does go over for a few days it does not amount to very much.

CHAIRMAN OWEN: What problem do you have in connection with the construction of new buildings so far as street cleaning is concerned? I am thinking particularly of residential buildings where the control is not as rigid as in the business district.

MR. CATES: It is necessary for a contractor to get a permit to put any material in the street where a building is under construction. They are not allowed to blockade the street, but they do use a considerable portion of it, and after the job is completed it is mandatory that the contractor clean the street and the sidewalk and leave both in as good condition as he found them. The Sanitary Department will not move anything connected with building materials.

CHAIRMAN OWEN: Do you have your own men enforce those regulations, or does the Police Department do that?

MR. CATES: The Police Department and the Building Inspectors.

CHAIRMAN OWEN: How do you handle that situation in Birmingham?

MR. BYRUM: We have practically the same situation as Mr. Cates in Atlanta. We, of course, work in close cooperation with the Building Department and

we have not a Sanitary Department in our city—we have just a Garbage Collection and Department of Street Cleaning. Those two departments work very closely together. The superintendent and the foremen on the various routes spot all of these offenses and we have by an educational program tried to teach our men in minor capacities how to explain the subject from the point of a clean city, and they do get fairly good results, although they do run into things they cannot handle.

CHAIRMAN OWEN: Do you think you should enforce those regulations yourself with your own men or do you think that that could properly be done by the Police Department?

MR. BYRUM: We get very little cooperation from our Police Department on matters of that nature. Now, all the men in my Department on down the line to the foremen, have authority to make arrests for any offenses of that nature that occur in their particular district.

CHAIRMAN OWEN: Do you think that is a good idea?

MR. ROOT: In my judgment it is not.

MR. BYRUM: We don't authorize these men, of course, unless we have specific permission to hold someone, and then we send the proper party out and if there is a case of a serious nature we ask always for a detail from the Police Department. We never do it but once or twice a year, because it is not a good arrangement at all.

CHAIRMAN OWEN: Do you think the Police Department should do that job rather than to have special officers in your own crew?

MR. BYRUM: Yes, and we request a detail on every occasion.

CHAIRMAN OWEN: What do you think of that?

MR. CATES: I can best explain that by our own set-up. Atlanta is divided into ten sanitary districts, each with its own inspector with police authority on matters of a sanitary nature or in buildings. He has the authority to make an arrest if necessary. For instance, a grader is grading a lot and he spills a lot of dirt all over the street. The inspector has authority to make an arrest and then this person is tried in the police court.

We find that a very good method because the inspector is always patrolling his district and watching for such offenses.

CHAIRMAN OWEN: What are your objections to that plan?

MR. ROOT: My objections are simply this: As I indicated in connection with some other things that have transpired during the last day or so, it goes from the concrete to the abstract. In other words, why should a Street Cleaning Department be a Police Department, or why should a Police Department be a Street Cleaning Department? Now, I think we should render efficient public service in all parts of our government. The Police Department has its work to perform and if they are not cooperating with the Service Department in connection with street cleaning, then there is an agency through which the Street Cleaning Department can approach the Police Department, which I think will force the Police Department to cooperate with the Street Cleaning Department. In other words, in giving the Street Cleaning Department certain functions to perform by way of citation, we are taking away a responsibility which is on the shoulders of the Police Department. Then there is no control because one will depend upon the other and you will get no results.

CHAIRMAN OWEN: How about that, Mr. Cates?

MR. CATES: Maybe I did not make myself clear. These inspectors do not

have police authority to the extent of arresting a man for speeding, but only on matters of a sanitary nature. Now, I might go a little further and say a lot of the cities have separate Street Cleaning and Garbage Departments, but that is not true in Atlanta, because all of those things are under the control of the Sanitary Department. For instance, smoke elimination is under the control of the Sanitary Department, sewer flushing is under the control of the Sanitary Department. I say those things to make that a little clearer. I think it works out very well in our case.

MR. ROOT: Just to confuse the issue let me cite these two examples. If the people are not wrapping garbage, or if they have a container that does not somewhat closely meet the regulations of the Waste Collection Department, our Waste Collection men have cards which they leave at the householder's door indicating in what way they could better cooperate.

And, the Superintendent of the Highway Maintenance Division under which Street Cleaning recently was consolidated, came in to me a few weeks ago with a similar card on which he had indicated certain things that he thought that his supervisors of Street Cleaning through the night or through the day could put on the automobiles indicating ways in which they could better cooperate with the Street Cleaning Department. And, one of them was, "Do not park after two A.M." What good would it do to put a tag of that kind up? In my judgment it consumed the time of the supervisors and it did not mean anything. However, if we had a regulation that could be enforced in the courts to that effect, then the supervisors could put that card on as sort of a courtesy card, and it would have some effect. However, I do not believe in wasting effort on something which is not going to be backed up.

CHAIRMAN OWEN: Now in regard to buildings and the *débris*. Is it necessary to keep *débris* out of the streets, especially if you have a lot of unpaved streets or unpaved driveways, from the standpoint of being an objection not only to the traffic, but from the standpoint of it getting into the catch basins? Do you have any problem with that?

MR. ANDERSON: We don't have that as our mileage of unpaved streets and driveways is very small. Our motor pick-up sweeper keeps most of that out of the catch basins.

CHAIRMAN OWEN: What about Toronto, Mr. Burnett?

MR. BURNETT: We have very few unimproved streets.

CHAIRMAN OWEN: Then you have no problem of dirt from an unpaved street washing into the gutters and getting into the catch basin?

MR. BURNETT: No, it does not exist to any appreciable extent in Toronto.

MR. BYRUM: It is quite a problem in Birmingham as about sixty per cent of our streets are paved and the other forty per cent are on steep grades and we have to watch them very closely. It is expensive, but there is no way out except to maintain a constant inspection at all such points.

CHAIRMAN OWEN: Does that mean you have rather frequent cleaning of catch basins in those areas?

MR. BYRUM: Yes, in certain areas.

CHAIRMAN OWEN: Are your inlets catch basin types or simply so-called inlets?

MR. BYRUM: They are practically all inlet type at the present time. In the whole downtown area the old-fashioned catch basins were built, but we have been eliminating those as fast as possible because in the summer time they are

breeding places for mosquitoes. We do not have any true catch basin types in the residential district.

CHAIRMAN OWEN: Do you think that muck should be carried away by the sewer down to the river or to the sewage plant?

MR. BYRUM: We try to prevent it wherever we possibly can.

CHAIRMAN OWEN: Do you have catch basins or inlets?

MR. ANDERSON: We have catch basins almost entirely. I think that is a matter of following a precedent. There is no longer any need for them.

CHAIRMAN OWEN: Do you mean the streets are so well paved that there is no need for them to take care of the stuff going into the catch basin?

MR. ANDERSON: Yes.

CHAIRMAN OWEN: What about Cincinnati?

MR. ROOT: We have some of both.

MR. CATES: Catch basins are one headache I don't have to bother with. However, that is under the Sewer Department. We have a very serious problem in our alleys. All alleys with the exception of two in the entire city are privately owned. The result is that the alleys are the hardest things in Atlanta to get anything into in the way of a garbage truck, as nothing is paved. We do have a world of trouble in rainy weather, especially with dirt washing out of the alleys into the streets. We have an organized crew that goes out immediately after a rain to various places we know are bad and cleans it up as quickly as possible, because when it rains and then dries up, there is considerable dust in homes or places of business and the owners let us know about it. However, I believe that within a comparatively short time the City of Atlanta will take over all the alleys. There is at present a peculiar set-up that the alleys are private property and they can keep certain classes of vehicles out, but the Sanitary Department has the privilege to use any of them at any time.

CHAIRMAN OWEN: How do you clean the catch basins?

MR. CATES: With convict labor.

MR. BURNETT: In Toronto we placed into service two auto-eductors. We use them in the northern part of the city. The other catch basins are cleaned by hand scoops and the material afterwards picked up by motor truck. The auto-eductors are very sanitary in operation and the material is raised by vacuum with an eductor nozzle and pumped into the body of the catch basin cleaner. We clean at the rate of about thirty-five to forty-five culverts a day with each of these machines.

CHAIRMAN OWEN: What method is used in Cincinnati?

MR. ROOT: We have auto-eductors and hand method cleaning. The older sections of Cincinnati were equipped with catch basins, but all of our newer sections for the last twenty years have been the inlet type of construction.

CHAIRMAN OWEN: Then you don't build catch basins any more?

MR. ROOT: We are getting away from basins each year. It is a part of our sewer maintenance problem and we eliminate as many catch basins as possible.

CHAIRMAN OWEN: If you eliminate catch basins and you have any street dirt, that means that it is all going into your sewer system. What do you find so far as sewer cleaning is concerned? Do you think it is necessary to clean more frequently in the newer sections than in the older sections?

MR. ROOT: I think it is true in Cincinnati that when catch basins were in vogue they did keep the grit and other materials from getting into the smaller-sized sewers, but as the city has grown and the older sections have been de-

veloped with paved streets, that material which used to be caught in the catch basins no longer exists within those areas. Now, in the newer areas, once it gets into the sewer system, it will be flushed through the system with no ill effects.

CHAIRMAN OWEN: Do you do any sewer flushing?

MR. ANDERSON: We do. In our case we have a storm system and a sanitary system. The most serious trouble we have with stoppage is not on the storm system but on the sanitary system which is due largely to the fact that the smaller-sized sewers running to stub-ends did not have sufficient flow in them to keep them clean. We handle that both by flushing and by dragging with buckets where necessary.

CHAIRMAN OWEN: Is it systematically done? Do you start out every year and decide you are going to flush sewers at least once?

MR. ANDERSON: We try to cover them at least once in two years. Certain sections we know to be bad we clean more often, perhaps every year, and in some cases it may be more often than that.

CHAIRMAN OWEN: Have you had any particular trouble with tree roots?

MR. ANDERSON: Yes, we have. We find that in many places within a hundred feet of a willow tree there is likely to be trouble. Poplar trees and in general any soft-wood trees are likely to have the same effect. Our public sewers are a little better laid and the workmanship on them is a little better than the house services which are laid by most any plumber who happens to get the job, and therefore a big percentage of the stoppage occurs in the house services.

For several years we have built our main sewers under specifications requiring a strand of oakum packed in the joint and then tightly cemented in. This in general acts to keep out roots pretty well.

CHAIRMAN OWEN: What has been your experience in sewer flushing?

MR. CATES: We have eleven men called flushers. Each of these men has a regular route and is required to cover that route at least once each week. With flushing of that kind we have very little trouble with our sewers on the point of gas odors and stoppage and that sort of thing. However, that is all handled by another department and I do not know much about it. I think from what I know of other cities that we have about as good a system as can be devised.

CHAIRMAN OWEN: Are there any regulations in your city in regard to the type of tree that may be planted on the street or on the driveway or on private property?

MR. ANDERSON: Yes, there are. The willow trees, which we find to be the worst, are prohibited entirely within one hundred feet of a public sewer. The other types of trees I mentioned are also prohibited in the streets. We do encourage the planting of trees, however. I think you will find more trees to the block in Winnetka than you will in almost any other town you might want to name, and it is largely due to the fact that the charm of the country life setting has been preserved in a more or less urban condition. We encourage the planting of trees in the park ways even to the extent of taking orders for trees which are filled by a local nursery service with which we have a contract at a very low cost per tree paid by the property owner.

CHAIRMAN OWEN: Do you allow people to go to any nursery and buy their own tree and plant it themselves?

MR. ANDERSON: They may do that under a special permit from the village.

CHAIRMAN OWEN: Does Cincinnati have any regulations concerning the planting of trees?

MR. ROOT: We have no regulations but we have what we hope is a little influence. We are discouraging our people from the habit of planting trees between the curb and the side walk, and we are trying to sell them on the idea of having them plant those same trees on their own property near the side walk.

CHAIRMAN OWEN: What experience have you had in Birmingham?

MR. BYRUM: We have no regulations as to the type of tree. Whenever any trees are uprooted, however, we urge the people to plant a certain type of tree and get away from the poplar and the cork elm which give us considerable trouble.

CHAIRMAN OWEN: Have you had any trouble of that kind in Toronto?

MR. BURNETT: The planting and all of the regulations of trees come under the jurisdiction of the Parks Department. All trees are planted on the city property between the street line and the sidewalk. The pruning, spraying, and maintenance of all trees or plant life on the city property comes under the immediate jurisdiction of the Parks Department. I presume like other cities the City of Toronto experiences considerable difficulty with respect to roots in sewers. The flushing of sewers and the control of all drainage systems and sewers comes under the sewer section of the Works Department.

CHAIRMAN OWEN: Nearly every one of the things we have discussed here demands for solution a certain amount of enforcement and rules and regulations and you might list under that category garbage receptacles, planting of trees, the spreading of building debris, either on vacant property adjacent to the new building, or in the gutter of the streets, and in the fall the question of leaves burned on the street or piled on vacant lots. I think from my own experience that enforcement probably has been the most difficult to handle.

The question in my mind is whether the Department of Public Works should, by continuously hammering at the Police Department, get them to watch for these violations, or whether it would not be best to have a sanitary squad in the Department of Public Works who were special officers. They might even be furnished with a uniform—not like a regular policeman, but with some other type of uniform, and be charged with the duty of enforcing regulations so far as garbage and refuse receptacles are concerned, and also tree planting and some of the other matters that have been mentioned.

It is particularly important in a town that is growing rapidly to have a group of men like that, and I should like to see something developed on this enforcement proposition. I am going to ask each of the men on this panel for his opinion of this matter.

MR. ANDERSON: I feel that the police function is not so well handled by the Public Works Department. We have one stunt, however, that worked out rather well, particularly in regard to building debris and other damage from building operations. When a building permit is requested, the applicant is given instructions as to what he may or may not do in the public streets. Among other things, he may not put any building material in the streets or parkway area except by special permit which he must obtain upon showing the necessity for it. Then we take a deposit, ordinarily for the usual small single family residence of about twenty-five dollars, which is to cover any damage he may do to any structure in the street, curbing, side walks, water service, and also

to insure that he will keep the parkway area and the streets clean. If he does not do so and it is reported by the Police Department or by our inspector, he is warned that if it is not cleaned up within a certain time the City will clean it up and charge him through his deposit. That has a very salutary effect. We have had little trouble with building débris.

CHAIRMAN OWEN: How about garbage receptacles?

MR. ANDERSON: In that case we leave a notice as to what the violation is and how it should be corrected. The notice is sent by the Department's office when the inspector or collector reports the offense. We feel it is better to have a notice coming from the office rather than from the collector as it will receive more attention from the householder, and in general the matter will be corrected.

CHAIRMAN OWEN: Suppose the householder does not do anything about it?

MR. ANDERSON: If it continues to be reported by the collector we write the householder a letter threatening to discontinue service, and if it is not corrected we do discontinue the service. However, we have had very few cases where that has been necessary. It is nearly always taken care of upon the second notice in writing.

CHAIRMAN OWEN: What about Cincinnati?

MR. ROOT: I feel that when we give service we will get service in return. We have had no trouble in Cincinnati on that. When we leave a notice that a container is not just in accordance with what we think it should be, they usually cooperate with us and get one. I find it is just the opposite—that we receive complaints about the waste collector damaging the containers and making them buy new ones too often.

If the Street Cleaning Department has a street to repair, we put up a notice on the poles reading "No parking, by order of Police Department," and there is no parking on that street during that day. And, if John Jones happens to die and the Police Department puts up that same notice on the poles, there is no parking. We have, therefore, received some cooperation in Cincinnati from the dead and the living!

CHAIRMAN OWEN: How about Birmingham?

MR. BYRUM: Our new fiscal year starts the first of September, but the appropriations have been delayed until October 15, and we are asking for an inspection department of enough men to take care of us. If we don't get them, then I have a little scheme that I have thought of and we may go ahead with it a little later. The scheme is that we would make a survey of our most frequently occurring offenses and list them, then take all of the ordinances and put them into readable terms and print a little handbook that will contain all the rules and regulations I am interested in. These I intend to use in the police patrol cars that patrol certain areas day in and day out. I plan to put the ordinances into readable form so that the officers can study them and be a little better posted on what is an offense against the City and against the various departments of collection and cleaning. It may work out and we may go through with it if we do not get those inspectors.

MR. CATES: Our Sanitary Inspectors are all required to go in uniform and carry a badge similar to a policeman's. On their hats they carry a sign "Sanitary Inspector." We do not have a great deal of trouble in enforcing ordinances of sanitary regulation.

You mentioned burning leaves on streets and I would like to say a few words about that. It is against our city ordinance to burn leaves on the street,

and it is necessary to get a permit from the Fire Department to do it. In that connection I should like to say that Atlanta won the national award last year for low fire loss. The per capita fire loss in Atlanta last year was less than sixty cents and this year it seems it is going to be less than that. That is because they put on a drive for cleaning up rubbish and they made the people fire conscious, but I want you to know it put plenty of work on the Sanitary Department because we are required to remove the rubbish. All in all, we seem to get along fairly well in enforcing our ordinances.

CHAIRMAN OWEN: We hear a lot about the law enforcement agencies in Canada, and so we would like to have your experiences, Mr. Burnett.

MR. BURNETT: It is certainly very gratifying to state that in Toronto there is a high degree of civic pride and I think in almost every Department the citizens respect all by-laws and we have very little difficulty in enforcing those laws.

With respect to the collection of waste material, the city is divided into three districts. Each district or division is in charge of a superintendent, each superintendent has a number of district foremen under his jurisdiction, and each foreman has a group of men. Complaints arriving at the office or by telephone are immediately transmitted to a divisional office or, if it is of such nature that an explanation is necessary, the district inspector will call at that house or place of business whichever it might be, and in almost every case we experience very little difficulty in getting close cooperation from the citizens. Our process is more of an educational system. I think probably it may be worthy of note that we have distributed by the Department a convenient blotter on which are printed the regulations governing the cleanliness requirements of the Department, and a picture of a garbage receptacle. During the summer we had a request from the school teachers asking that we send some of these blotters to the different schools. In that way the children are educated even in school life to respect the by-laws of the city. By training the children in early life that habit grows on them and they will develop to be good citizens and cooperate in every respect with our requirements.

SUMMARY

MR. T. R. KENDALL (New York City): The major point which seems to have been brought out in this panel discussion is that the most effective operation is secured through cooperation among departments, the citizens, and the officials in charge of the various cleaning operations.

Mr. Root and Mr. Burnett have brought that out particularly. I don't think that we can characterize Toronto and Cincinnati as most unusual cities, although I realize that the southern communities perhaps do have a greater problem in their negro population, but there are other cities which have large proportions of foreign born population which do not cooperate any too well with the cleaning department.

In street cleaning problems it would seem that the minimum of difficulty from obstruction such as automobiles that are parked on the street is experienced in those cities where flushing is used. At least, the flusher reaches under the parked car much more efficiently than the white-wings' brooms. Any other form of machine cleaning requires that the vehicle be driven around the parked car.

In one of yesterday's sessions the remark was made by one official that one

of his predecessors had a great reputation for having the cleanest streets the city had ever had from its inception, and from his later remarks I gathered that this was due to the fact that the flushers paraded down the main streets in the daytime where they could be seen by everybody.

Now, whether the New York City officials have heard of that I don't know, but no matter where you go in New York City now from a residential district toward the business district a flusher precedes you. If you go toward the theatre district at night there is a flusher there, so that you always are walking in pools of water.

On the question of catch basins or inlets, it would seem that with the increased paving of individual streets, alleys, etc., the catch basin has become outmoded. Perhaps the elimination of the horse from our streets in a large measure has also helped that. Perhaps the same applies to the question of sewer cleaning, for the gentlemen seem to feel that there is less sand and silt in their sewers.

The root question also seems to be one largely of the house service rather than of the main sewers. It seems to me this is due chiefly to the fact that the local plumber, without much supervision by an inspector of the Sanitary or Sewer Department, installs the house service or house drains, while you require the contractor who puts in your main sewer to live up to the best specifications you can devise, with plenty of inspection.

I was very much interested to note the unanimity of opinion that it is a good idea to keep soft-wood trees such as willows, poplars, and one that I had never heard of before, the cork elm, away from the area between the sidewalk and the curb.

The enforcement of sanitary regulations has brought out more diversity of ideas and lack of unanimity of opinion than any other matter discussed by this eminent panel. I think perhaps that the suggestion made by Mr. Burnett to start with the school children in our educational program for cleanliness is the best one I heard. We are all of us old dogs and we don't learn new tricks. I'll bet half of you men who are responsible for the cleaning of streets still drop your cigarette packages in the gutter.

It would seem that inspectors, called either sanitary inspectors or public works department inspectors, with police powers should be quite effective in enforcing the various regulations. I don't refer merely to littering, but the various regulations necessary to proper municipal housekeeping. Few householders relish having a policeman visit their door. The neighbors are always suspicious. A well dressed inspector does not look like a representative of the police department or the sheriff's office, and with the proper selection of the type of man, he can undoubtedly accomplish more than a visit from a member of the police department.

In closing I want to congratulate Mr. Owen on his handling of the first panel that this Congress has had.

GENERAL DISCUSSION

MR. M. C. GEAREN (Racine, Wis.): I should like to ask Mr. Kendall what has become of Mr. McCrain of the Anti-Litter Society, a former member of our association. He told how he went to the schools and had the children educated to keep the litter off the streets of New York. I know at our meeting that time

he gave a wonderful talk on that subject, but I have not seen nor heard of him for a few years.

MR. KENDALL: Unfortunately that program has not been continued, but I don't know what happened to Mr. McCrain. Just at present the Commissioner of the Department of Sanitation has appointed a squad of some fifty inspectors, so-called, who tag you all up and down Broadway if you leave your Lucky Strike or Old Gold package in the gutter. It is an attempt to educate the old dog instead of teaching the pup proper house manners. I think you should start with them young, and I am preaching that same thing in the highway safety campaign. I think you can teach more to the young than you can to the man who has been driving thirty years and thinks he knows it all.

MR. S. PINEL (Louisville, Ky.): We have a problem in connection with garbage cans that is rather serious and I suspect it is so in some degree in other cities. That is, the people in the poorer districts are unable to buy containers. And, if they do buy one, they cannot afford to buy the second one when it is required. I have no solution to that but I would like to get one. Are any other cities doing anything in that connection? Should we pass up the matter and let them use some other can, or should we furnish a can to them? Or, do you stop collection entirely?

MR. E. H. GERLACH (Milwaukee, Wis.): I am going to start on something that took place in the panel discussion. First, I would say our City is supposedly as nearly like Toronto in its make-up as any city I know of. In other words, it is a very well-governed, orderly city.

We have a Forestry Division which controls the planting and maintenance of trees. No one is allowed to plant trees within the parkway area unless a permit is obtained from the Forestry Division, which is a sub-division of the Park Department. In this way objectionable types of trees are not permitted on the streets.

The matter of enforcing ordinances, I would say, reverts back to organization. In organizing a department, I believe it has been brought out that authority should be centralized in one head. I should not want the Police Department to enforce my garbage regulations. I believe a man who is specialized in that training, who is familiar with the needs and the circumstances of the city in that particular field, should be the one to determine what is necessary and what is not necessary. And that leads us up to the question that the gentleman from Louisville asked. We have drawn up what we term the rules governing the collection of garbage. These rules explain in common, every-day language which is understandable by the entire population of the city, what is best for the Department.

We have a man who periodically goes with the collectors from one end of the route to another. He notes all violations of any requirements of the Department and if any violations exist he will leave a notice with the householder which reads something to the effect that the following rules governing the collection of garbage have been violated. We find that by seeming to request cooperation rather than forcing a lot of cold-blooded ordinances down the throat of the public, we get better results than by trying to whip them into shape by severe means.

I happen to be fortunate in having several field supervisors under my charge who are very efficient. These field supervisors are frequently called upon to give talks before civic organizations, school classes, etc., and I am thoroughly

in accord with the idea of getting them while they are young and telling them plenty. We find that by so doing the children will even correct their parents in their negligent habits. The results of our so-called educational campaign—which should never be considered too lightly—have been very good. I will say, however, that the man who goes around and condemns cans and inspects the manner in which the cans are placed and how the garbage is being kept should be a man who possesses a high degree of diplomacy. The approach to the various types of people necessarily requires that the man be able to shape himself to the particular circumstance in the case.

In Milwaukee we have very close cooperation between the various departments. I would not like to see any of my men, no matter how diplomatic they might be, vested with police authority. It might lead to a lot of abuses, and would tend to create trouble rather than to appease the public. If any violations exist and a particular householder refuses to cooperate, we notify the Health Department. The Health Department has cooperated with us one hundred per cent and it is the Health Department's duty then to cause the arrest and try the case for whatever the offense might be.

Now, to answer that question I might say this: Milwaukee is not entirely without the so-called poorer element, and particularly during the depression we found there were many people who were so financially situated that it was impossible to buy containers. Of course, it may have been the experience of a good many in public service that the so-called depression was a little overdone and they were all hiding behind the "No money" phrase, but the man who goes around to make his condemnations or corrections should be a man who has the highest degree of diplomacy and in many cases where the first report was "No money," we later found that money was available for the purchase of a can. However, in cases where it was absolutely impossible for the people to buy a container, we allowed them to use some other type of container or we provided them with one for sanitary reasons. We find that by so handling the people, as soon as they have the means to buy a container, they buy one without further warning on our part. We have had very good results through such an educational campaign which tends to create a spirit of cooperation between the public and the city officials.

MR. G. PHELPS (Toronto, Ont.): I would like to find out if an inlet to a sewer is ever used on anything but purely a storm sewer. In Toronto our system is almost entirely a combined system, and while I am not quite against an inlet in preference to a catch basin in an ordinary way, I would prefer that Mr. Burnett collected the leaves and burned them rather than to let them come down and catch them on the screen. Apart from that I would not be against an inlet except for one thing, and that is that we always trap our catch basins and they are alongside the sidewalk, and as ours is a combined system, there is a tendency wherever a trap is broken for odors to escape. There is some discomfort and we do at times receive complaints.

MR. ROOT: Speaking along the theoretical lines of designing inlets or catch basins, inlets are used only on storm sewers or combined sewers.

MR. H. J. LEARY (Philadelphia, Pa.): It seems to me that Philadelphia is at least a step ahead in police cooperation with the Department of Public Works and perhaps the experiences we can relate might be of some benefit.

The present administration went into office at the beginning of January, and we found immediately afterwards the usual type of letters coming into

the Mayor's office about streets being littered and in an unsightly condition. They happened to be turned over to me and I endeavored to solve the situation. We looked over the correspondence of the preceding administration for a period of twelve years and found that in a great many cases it had resolved itself into a buck-passing contest between the Department of Public Works and the Police Department. When the complaints came in they were answered by saying that it was a police problem and the matter was being referred to the Department of Public Safety, which of course, had control of the Police Department in Philadelphia. We contacted the street supervisors, the superintendent of police, assistant director, and director, laid our cards on the table and asked if this administration was going to follow the action of the preceding administration, and whether we were going to enter into a buck-passing contest, or really try to solve this situation. They asked us what we wanted and we said this: We do not have any police powers and so what we need is your cooperation. And, we said, cooperation meant that we wanted it from the 4500 men who constitute the Police Department to enforce the existing ordinances.

As a result of that conference we received a sergeant and a detail of men who were placed in the Department of Public Works under the supervision of the Director's office. We allowed them to be there for two months, during which time we fairly saturated those police officers with problems relating to the Department of Public Works. At the end of that period we laid out a campaign with printed material and emphasis on educational values. We then had a meeting of the inspectors in Philadelphia. (We have forty police districts under the control of a Captain, and those Captains are responsible for six inspectors.) Our sergeant was present at the meeting. We had broken down the problem as to waste, the conditions as to placing the material for collection, and what happened to it on the sidewalk between the time it was placed there and the time the wagon picked it up. The result was that where abnormal conditions existed the police officers called upon the house owner and served notices. In the meantime the Captain of the police district in which those men were working was instructed by the inspector to place two men with our squad so that they would be broken in as to the type of work they were expected to perform. I would say that we have covered about forty per cent of the area of Philadelphia with our detail and we leave the local police officer to look after that district. There has been a very noticeable improvement in the type of complaints being received as well as a reduction in their number.

I would say that we are on a fair way to solving what was a very bad condition at the beginning of the present administration.

We have a large foreign element in one section of Philadelphia and in that particular case we had to resort to summons. For instance, we had to take away sixteen loads of celery leaves and all of the other things that the merchants discarded on Sunday morning after the close of the Saturday night business, within the radius of four city blocks. We concentrated on one particular curb market with between 250 and 300 pushcarts and each merchant now has his own container and they have established a fund among themselves to maintain their own private collector who makes three collections a day. We have done that with the aid of the police unit.

We have solved this problem not through any additional police power,

but simply by bringing about coordination between the Department of Public Safety which, after all, in the final analysis is the department responsible for the enforcement of existing ordinances.

CHAIRMAN OWEN: Can someone answer the question put by Mr. Phelps?

MR. W. B. SHAFER (Pittsburgh, Pa.): Although the topography of the City of Toronto is different from Pittsburgh, Pittsburgh was also taken care of by combined sewers. However, in later years we have gradually and as rapidly as possible installed the storm sewer system. But in the hillside districts, of which we have plenty with grades of twenty to twenty-five per cent, we find the old sanitary sewer combined with the storm sewer.

Also, wherever we have to install a new catch basin we put in a false bottom and try it out as a storm inlet where the velocity of flow will be such that there will be no odors coming back. However, where the velocity of flow is not sufficient to prevent that odor, we have it designed so we can take out that false bottom, which is just a soft concrete, and install a trap right over the outflow. In that way we get about six inches of a trap of a basin at the bottom and we seal the odors in that way.

We are doing a lot of work in connection with WPA, and have put in two or three hundred catch basins. They are designed a little smaller than our ordinary catch basin. Our idea is to make that storm inlet so there will be a direct flow, but we have taken the precaution so that by just installing a very simple trap and connecting it to the brick works with expansion bolts, we can overcome the nuisance.

MR. D. W. GODAT (New Orleans, La.): I left the room and my question may have been asked and answered. It is in regard to garbage cans and covers. We have in New Orleans a district called the "French Quarter," where people will put out containers not according to regulations, many of which have no covers at all. If we were to enforce the regulations of picking up all containers that were not according to regulations, we would pick up ninety-nine per cent of the cans in that district. We can't do that because we don't have a sufficient amount of equipment to haul the cans in addition to the garbage. A solution must lie somewhere, because you cannot have garbage sitting in the city streets, nor can you pick up all the cans of that nature. I was wondering if some of the other communities may not have been faced with a similar problem and arrived at some solution.

I think the gentleman from Winnetka made the statement that containers not according to regulation were spotted immediately and a notice left with the property owner that in the event he did not comply with the request of the Department his service may be discontinued. I was wondering if that would be practical, because if you do not continue to collect the garbage you would create a condition that would be a health nuisance.

MR. ANDERSON: It is practiced as a threat only. We very rarely have to do it. And, in case it is necessary to do something drastic, we can bring it into court.

MR. E. H. GERLACH (Milwaukee, Wis.): If the ordinances are not complied with in the fashion that our Department requires, we absolutely stop collection and turn such matters over to the Health Department. They may give the occupant so many hours to get rid of the nuisance himself, and if he does not do it, he is hauled into court and the consequences will follow. While you practice the theory of cooperation, you also must show that beneath the gloved hand you have a mailed fist.

MR. L. F. PECK (Hartford, Conn.): The method just described is the way we handled it in Hartford. The Health Department has power to cause any occupant to remove or clear up any objectionable material.

I was a little surprised that there should be trouble in getting replacements of such a small insignificant thing as a garbage can, and the thought came to me that perhaps you are asking the tenant, whoever he might be, to make that replacement. In Hartford the owner of the property and not the tenant must furnish the receptacle if it is more than a two-family building, and the Board of Health there has the authority if upon notice of the Public Works Department such receptacle is needed and not complied with, to cause that to be done. There has been no trouble in enforcing these things as there is cooperation of the Health Department and also of the Police Department.

MR. D. W. GODAT (New Orleans, La.): Our problem is not just scattered residents, who would be relatively easy to handle, because they can be hauled into court. I am speaking of a large section of the city inhabited by people who have moved in after others have abandoned the places or rented them out. I don't know how many thousand live there, but I suppose the area covers at least two square miles. The violations in that section are quite numerous and you could not take up all of them nor could you haul an entire community into court.

In answering your question, the tenant is required to provide the pail and the owner has nothing to do with it.

MR. S. PINEL (Louisville, Ky.): In my original question I was speaking of the very poor district where the purchase of a garbage can is not a small item. I know that Hartford does not have that situation. I lived there a couple of years and you have no district there that corresponds with the colored district in Louisville. Our garbage can is a big item. It costs eighty-nine cents or a dollar and it has been impossible to get them to buy them.

MR. PECK: I would recommend an ordinance requiring the owner to furnish the can for two-family houses.

MR. J. S. FLOCKHART (Newark, N. J.): I have enjoyed this discussion very much and particularly as it brings up some of the things we have been trying to get together in the Manual concerning Street Cleaning and Catch Basin Cleaning and I wonder if I might ask the members of your panel a few questions to clarify some of the things that have been brought out.

First I want to congratulate Mr. Burnett on the clean streets of Toronto as he is doing a very good job. How much do those carts weigh?

MR. BURNETT: The pushcarts are comparatively light and quite easy for an average man to push when loaded. The topography of Toronto is such that it is not hard to push them. Of course, in the hilly district these pushcarts are not used; they are used only in the downtown district. The street cleaning in the residential district is done by and under the jurisdiction of the collection wagon, and usually on Wednesday afternoon and Saturday when the equipment is not used in the collection service.

MR. FLOCKHART: Do you find that you have accidents with them on account of the traffic? That is, do any of your men get injured on account of accidents?

MR. BURNETT: No.

MR. FLOCKHART: Do you use flushing as the primary cleaning or is that complementary to your hand broom?

MR. BURNETT: The city is divided into districts and we try to flush every

street in the city. We endeavored to do that this past summer with six motor flushers, and the street is patrolled by a street cleaner the day previous to the day of flushing.

MR. FLOCKHART: You believe that the flushing should come afterwards?

MR. BURNETT: Yes, and the litter should be cleared before the streets are flushed.

MR. FLOCKHART: You spoke about cleaning thirty or forty culverts per day with the auto-eductor. What capacity are the catch basins?

MR. BURNETT: They are three feet square and six feet deep, and that is two cubic yards. We endeavor as far as possible to clean our culverts twice a year—in the spring and in the fall. We also maintain an emergency squad in case of the culverts being blocked or a trap being blocked and causing flooding at night, so we have twenty-four hour service including Sunday. The systematic cleaning semi-annually of the culverts and the emergency service takes care of the situation without many complaints.

MR. FLOCKHART: How much material do you think you get out of a culvert at one cleaning?

MR. BURNETT: That would depend upon the district, upon the number of times it is cleaned, and the amount of service that that street receives so far as cleaning is concerned.

MR. FLOCKHART: How many cubic yards would you say the average basin contains?

MR. BURNETT: I would say we endeavor as far as possible to keep the portion of the catch basin above the trap clear so that the sump would receive all of the gritty or sandy material and not allow that to go down into the sewer.

MR. FLOCKHART: What is the distance between the bottom of the catch basin and the trap?

MR. BURNETT: I believe the traps are below the frost line, which is about four feet in Toronto. The catch basin is six feet and that would give you a sump of approximately two feet. That would be three feet square by two feet, or two-thirds of a cubic yard.

MR. FLOCKHART: I notice you have two types of paper cans, one closed with a swinging door and the other the open type of can. Are you changing over to the open type of can?

MR. BURNETT: The Commissioner is endeavoring to eliminate the cabinet as far as possible. We find the small open cans placed in close proximity to a post are more convenient and less expensive.

MR. FLOCKHART: How do you go about recruiting your street personnel? Is that done through examination?

MR. BURNETT: We have no civil service in Toronto. Our street cleaning service is made up of seasonal men who are taken on for removing ice early in the spring and are maintained until approximately the end of November each year. There is, however, a certain staff maintained permanently to clean the intersections during the winter.

MR. FLOCKHART: You were talking about the education of the school children. Does your Department go into the schools and give talks?

MR. BURNETT: No, we provide the literature and the rest is done by the school teachers.

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the powers of the Board of Health and your sanitary inspectors, or are they one and the same?

MR. CATES: The Board of Health is a separate organization. They have their inspectors just as we do, who inspect food and conditions inside the house. The Sanitary Department has jurisdiction over all matters outside of the house and the Health Department has jurisdiction over all matters inside the house. Their duties are so well defined that there is no conflict.

MR. FLOCKHART: You said the sewers were cleaned by convict labor, didn't you?

MR. CATES: Yes, under what we call the Construction Department. The Sanitary Department has nothing to do with that.

MR. FLOCKHART: How do you charge the unit cost? How much does it cost to clean a sewer?

MR. CATES: I don't know what the set-up is. It is handled by another department and we have nothing to do with that.

MR. FLOCKHART: Do you work your brooms on double shift or only one shift?

MR. ANDERSON: It is not necessary to have more than one shift.

MR. FLOCKHART: You talked about the house service being laid from the street. Do I understand that that is the main sewer direct to the houses?

MR. ANDERSON: Yes, and maintained by the owner.

MR. FLOCKHART: If he has a leak and has to hire a plumber and the plumber has to break the pavement to get to the leak, does he have to replace that pavement?

MR. ANDERSON: He has to pay the charge for opening the street, but we replace the pavement and make our own back-fill.

MR. FLOCKHART: Mr. Byrum, I was interested in your statement about the sewers having no catch basins. Are your grades generally heavy enough to take care of that? I understand you have no catch basins in your sewer system at all.

MR. BYRUM: It is not a true catch basin type. We have a few that have been there thirty or forty years, but they are just a mere basin-type inlet with a straight deflecting drain to the sewer. We do not have a sump.

MR. FLOCKHART: Are your sewer grades heavy enough?

MR. BYRUM: Yes, we have a splendid system of grades in Birmingham and in fact we have trouble with a lot of our big brick sewers and concrete sewers in scouring out the bottom.

MR. FLOCKHART: Are they connected?

MR. BYRUM: The two are separate and distinct. We do not allow them to be connected under any circumstances.

MR. FLOCKHART: Mr. Root, what do you do about parked cars?

MR. ROOT: Just run around the car, but we do maintain in the downtown district a patrol of white-wings, organized mainly to keep the downtown sidewalks clean. Cigarettes and cigar butts, and the papers you usually find on downtown streets are shoved into the gutter and the patrolmen broom them up and take them off in a little pushcart.

MR. FLOCKHART: Do you assign another man with the sweeper or does the man who operates the sweep work alone?

MR. ROOT: He works alone.

MR. FLOCKHART: Where you are sweeping past a catch basin or inlet and

there is a depression there to take the water, how do you keep that clean?

MR. ROOT: We make the little pile just prior to the entrance of the inlet.

MR. FLOCKHART: I am thinking of the auto sweeper.

MR. ROOT: Unless I am misinformed, they have a little gutter broom that throws it away from the inlet and not into it. We are a little rough with our personnel and not so much with the public in Cincinnati and we watch that very carefully. If we find one of our sweepers or white-wings brooming into the inlet, it is his misfortune and not the public's.

MR. FLOCKHART: Is the basin cleaning under the Bureau of Street Cleaning or is it under the Sewer Department?

MR. ROOT: As we are organized, the street maintenance problems are in what we call the Highway Maintenance Division and that includes street cleaning, street repair, sewer cleaning, catch basin cleaning, sewer repair, street signs, loading platforms, traffic markings, and all of that.

MR. GALLIGAN (Chicago, Ill.): What I seem to get out of this discussion, Mr. Chairman, is that so far as street cleaning is concerned, there is nothing new under the sun. I think if Mr. Kendall lives to be a hundred years old, and before he celebrates his one hundredth birthday, if he walks down Broadway he will find the crowds along the thoroughfare throwing the cigarette packages in the street the same as they are doing today. All cities have their problems, and the larger cities differ somewhat from the smaller cities.

Theoretically I believe the cleanliness of a city's streets and alleys are determined by the amount of money appropriated for that purpose, provided the money is judiciously spent, but actually I believe a city is only as clean as its people. I think that is particularly true of neighborhoods too. There are sections in every city that are always kept scrupulously clean because the people will it so. Then there are other sections that are only passably clean where the people might be clean if they wanted to. Then, there are other sections which are always hopelessly littered despite all the efforts of the street cleaning officials to keep them otherwise.

The query from the gentleman from Louisville is timely since the depression—the matter of buying a garbage can. That is a very serious problem with many families and in a large city like Chicago we have a large area of people in modest homes who were hard hit by the depression. They probably were not able to get any relief, and in a situation like that the buying of a garbage can was a serious problem. What we did in that section might be of interest to some of you. It could not be done in every city, but it might be done in some of the larger cities. A few years ago we accumulated a number of large oil drums that did not seem to have any value and in that particular section there were oil refineries where they could be easily obtained. We cut the top out of them and they made an admirable ash and trash can. In that particular section we have more than fifteen hundred of those oil drums now doing service.

Philadelphia is fortunate indeed in having a young vigorous administration coming into power, and we all know that a new broom sweeps clean. Of course, they are fortunate in getting the helpful cooperation of those Departments that are essential to keep their city clean, and if he can continue that cooperation, Philadelphia is bound to be a very clean city. But, I would be very much interested in knowing if his enthusiasm will be as great three years from now as it is today.

MR. J. H. MOORHOUSE (Highland Park, Mich.): One of you gentlemen said he had an ordinance prohibiting the planting of trees within one hundred feet of the sewers. I would like to know if you have done anything about the removal of those trees?

MR. ANDERSON: We put on a drive when that ordinance was put into effect and in the course of which time notices were sent to all property owners who had trees that fell within that area, and approximately ninety per cent of them were removed without any further ado. We did run into a few stubborn cases and I think at least one or two of them were taken to court, and the ordinance was sustained.

CHAIRMAN OWEN: I have not heard anything about concrete receptacles. One time in the City of Dearborn when we were having considerable difficulty with garbage cans without lids, I thought we might make an arrangement with some of these people who manufacture the concrete receptacles and offer them to the householder at a greatly reduced price. I also thought that that same procedure might be used with the metal receptacles. We could simply act as a broker and by buying in large quantities we would be able to sell them probably for fifty or seventy-five cents. I wonder if that has ever been tried.

MR. KENDALL: Yes, it has been tried, and I have a record of several cities in the South which purchased a standard garbage can in large quantities, several thousand of them, and required the use of that type of can. However, after the householder had purchased one, the City thereafter replaced it when it was badly damaged.

CHAIRMAN OWEN: After all, I believe Mr. Cohn has the solution.

MR. COHN: On my trip to Lansing, Michigan, a year ago, I had occasion to see a very splendid method of handling garbage cans. There, as Mr. Kendall has indicated, the city purchased a can of a specific size and shape and these cans were collected from the householder, stacked in the specially prepared garbage truck, brought to the central collection station and put through a washer and sterilized. As a result the cans that were constantly in service were in an odorless condition and were not subject to all of the picturesque difficulties that I described in my literature to the members on the subject.

MR. M. C. GEAREN (Racine, Wis.): The City of Fond du Lac used to buy cans and furnish them to the residents, collect the loaded ones with a big truck and leave an empty container in its place. However, they have given up that practice.

I believe Huntington, West Virginia, has the same proposition.

At our State Park we had some barrels painted for containers, with the top white, the middle aluminum, and the bottom red, but the difficulty was that it took two men to handle them.

In the City of Racine we have a garbage can not to exceed two bushels. The landlord or tenant must procure that kind of a can with tight fitting cover, and all garbage must be drained and deposited in the cans wrapped. Then our men go around and pick them up, working on each side of the street. We are very strict about covering the cans. If anything out of the ordinary happens, the health inspector goes around there and explains things, and he never has to go back a second time.

MR. G. PHELPS (Toronto, Ont.): I was very much interested in what has been said about the inlets and catch basins. I gather that the inlet must be a great deal cheaper than the catch basins, and that if one can get along without

the catch basin, the inlet would be the ideal thing. However, in the winter time in the northern climates the frost goes down three or four feet, and I wonder how an inlet would behave itself at that time and also in the spring when the snow goes away and the ice is left. We will have water trickling down during the day and freezing at night. Would not that inlet freeze up altogether?

CHAIRMAN OWEN: Has anyone had that experience in the northern countries?

MR. ROOT: We are in between the northern and the southern climate and we find it necessary at times to cut that ice by salting.

MR. COHN: Perhaps I misunderstand the question, but it appears to me that the inlet is less subject to freezing difficulties than the basin itself. The inlet is directly connected by gravity to the storm water line and if it starts to freeze then the natural gravity fall from the inlet to the line will keep the line and the inlet completely clear.

Now, on the other hand, catch basins are prone to freeze because they contain a body of water in the basin area, and if you have serious frost conditions, basins do freeze up and clog the siphonic arrangement in the storm system and thus cause difficulty. Perhaps I have misunderstood the question.

MR. PHELPS: Usually the catch basin, as pointed out, is about two feet in diameter and as water drains to the bottom it must go below the frost line of four or four and one-half feet. As the ground is not usually frozen at that depth, there is not the same clogging up. However, in the inlet type they are narrow and conducted in an eight- to ten-inch tile or iron pipe. If it is an iron pipe, I suppose the pipe would be split and as it is a much narrower opening it has much more chance of flooding.

MR. COHN: I never heard of the actual freezing of a storm sewer. If the line itself does not freeze the inlet will not freeze. There is no water standing, as it is a non-retainable inlet basin and as fast as the water comes in it runs out.

CHAIRMAN OWEN: I might add this: In Michigan at one time the Road Commission built inlets on one side of the street and catch basins on the other side and the inlet drained into the catch basin. Now, the outlet from the inlet was just underneath the concrete slab and I never heard of any difficulty from that arrangement at all.

MR. A. E. ROCHE (Troy, N. Y.): I wonder if any member of your panel individually or collectively would like to contribute or trade \$32,000 for \$13,250? I would like to get that sum individually or collectively, and particularly from my associate, Mr. Root. I have been making some calculations here that have to do with the cleaning of catch basins, and I find these facts: At Troy we clean an average of nineteen a day out of 3,700 basins and in the course of 225 days we have a collection of about 6,700 cu. yd. of material. That sum multiplied by our cost per unit is \$13,400. We cleaned some storm sewers and our cost of removing from the storm sewers was at the rate of \$4.20 a cubic yard. I am anxious to see a continuation of catch basins because I am satisfied that it is much cheaper to clean a catch basin per cubic yard than it is to clean a storm sewer per cubic yard. In fact, the difference between the cost of cleaning them would be \$13,250.

MR. BURNETT: I have some figures here in our commissioner's annual report summarizing the culvert cleaning for the year 1935. It shows the number of cubic yards removed as 8,070, the number of catch basins cleaned 48,874,

and a cost per cubic yard for cleaning and removing of \$1.73. It also shows the cost per catch basin per cleaning as 28 cents. That is hand removal by scoops, and then removal by motor truck. I don't know what the cost of our catch basin cleaning will be with our auto-eductors.

MR. W. E. ROSENGARTEN (Ardmore, Pa.): In the lower part of Merion Township of Pennsylvania, we have been gradually eliminating the silt pits and to date I know of no case where we have had to clean out a sewer due to deposits from not having the silt pit catch basin. I think it eliminates the mosquito breeding pits and saves considerable money. It is true that a good many of our storm sewers lead into smaller streams, and possibly if we ever should have to close in some of those main streams there might be a possibility of deposit, but would it not be cheaper? Besides there would be fewer mosquito breeding possibilities if we put one large silt pit at some place where that might develop.

MR. E. F. MARTIN (Montclair, N. J.): We use catch basins in the entire city. Our catch basins are about seven and one-half feet below the finished road bed and four feet in diameter. If your storm water was discharged into your inlet and that in turn went through a box culvert in a low section, you would have considerable difficulty cleaning that out. I am of the opinion that the catch basin is an ideal collection.

MR. D. W. GODAT (New Orleans, La.): I would like to ask some member of your panel what is the average length of a patrol and the corresponding route of a broom-swept area.

MR. BYRUM: It varies so much with our frequency of collection and cleaning that it would be impossible to answer that question. The shortest one we have is eight gutter blocks. That is four blocks with both sides. However they vary all the way up to twenty-four gutter blocks.

MR. GODAT: What would your distance be in the residential section for a man with a broom followed by a truck or a wagon?

MR. BYRUM: We have organized hand crews that also vary because we have not the funds to do what we would like to do. In some residential areas we clean twice a week while in others we clean only once a week, and in still other sections every other week. We stretch the budget as far as we possibly can. We use convict labor and sometimes we have a good crew that will do twice as much work as others.

MR. W. B. SHAFER (Pittsburgh, Pa.): We have about sixty men on hand cleaning and some of them are on beat patrol. We figure an average of a half mile per man on our beat patrol, and our mechanical sweepers will average about fifteen street miles per day. That is close to twenty-eight to thirty curb miles. We cover seventy-five per cent of our paved streets with mechanical sweepers working on a sixteen-hour shift.

ORGANIZATION AND ACTIVITIES OF THE TORONTO DEPARTMENT OF WORKS

R. C. HARRIS

Commissioner of Works, Toronto, Ontario

THE Program Committee has assigned me a considerable task in asking that I deal with the organization and work of the Toronto Department of Works in the space of thirty minutes. You will therefore appreciate that this presentation must be skeleton in form and clothed only with abbreviated explanation, largely superficial.

The municipal government of Toronto is strictly nonpartisan. Elections are decided upon municipal, not political, issues. This is reflected throughout the official service, where capacity and character of the individual, as related to the duties pertaining to the office, are the qualifications considered in appointment.

Heads of civic departments are appointed by the City Council and hold office as long as they demonstrate fitness.

Discussion of policies and works are public.

Heads of departments are encouraged to exercise initiative and are accorded opportunity to express their views in writing, and on the floor of Council, where they are invited to contend orally for their viewpoint, even though it be opposed to that held by the elected representatives of the people. They are clothed with plenary authority as related to appointment, discipline, and dismissal of all the employees of the department and are held accountable by the administration for results. Even though their views may differ diametrically from those held by the elected representatives, rancour does not result, as both appreciate that the impelling motive is a desire to conserve adequately the best interests of the City. This system has produced a very happy situation, wherein each strives for the adoption of his views while always considering and respecting contrary opinion. Continuity of service is marked, and almost without exception various departmental heads have been promoted to their positions after extended periods of service.

The Department of Works of the City of Toronto is organized with eight Sections, for purposes of administration and operation.

These Sections are Head Office, Roadway, Sewer, Railway and Bridge, Water Supply, Water Distribution, Accounting and Purchasing, and Photography and Blue Printing.

Each of the five operating sections of the Department, viz., Roadway, Sewer, Railway and Bridge, Water Supply and Water Distribution, have an Engineer and a First Assistant Engineer in charge of a complete organization for the handling of their work.

I shall outline the organization and activities of these Sections.

HEAD OFFICE

The operations of the Department are directed from Head Office, at which are located the Commissioner of Works and City Engineer, Deputy City Engineer and Principal Assistant Engineer, who are the chief Executive

Officers. All departmental activities focus at this office. You will observe that the offices of Commissioner of Works and City Engineer are combined. Such official is appointed by the elected administration and is wholly responsible to such for the operation of the Department.

The general work of Head Office is under the supervision of an Executive Assistant. All departmental correspondence is centrally controlled, distributed, and filed. By means of a follow-up system on sections, prompt attention to all matters is secured or a report procured explaining reason for delay. There are Statistical and Record divisions and a Departmental Library which is stocked with standard works and periodicals dealing with matters concerning or akin to our activities. These are available to all members of the staff, thus keeping them abreast of current practice and experiment. Connected with this Office is a service division, where applications for the installation of private drains and water services to street line and the repair of existing drains and services are taken. In such division there is a teller who receives all moneys payable to the Department. These moneys are deposited daily to the credit of the City Treasurer and are checked by the City Auditor who examines the records and accounts as he may determine, without notice.

ROADWAY SECTION

The Roadway Section has general jurisdiction over the public streets and lanes of the city and deals with all matters relating thereto.

For purposes of convenient and economic operation, the section is divided into the following sub-divisions:

Office (including survey, draughting and estimating), Day Labor, Contract, Asphalt Plant, Maintenance, and Area and Sign.

Local Improvement recommendations for the grading of unimproved roadways and the construction of pavements, sidewalks, curbs, etc., are furnished, and when the by-laws authorizing such works are passed, plans and specifications are prepared and tenders invited. The Department submits tenders in competition with contractors, thereby fairly regulating prices and effecting considerable saving to property owners. If the tender of the Department is lowest, the work is either constructed by the Day Labor forces, or, on request, is transferred at the tender figure of the Department to the contractor submitting the next lowest bid.

The Day Labor organization is maintained for the construction of Local Improvements awarded the Department on tender, and other works ordered by Council.

Inspectors of long experience and proved merit thoroughly supervise all work done by contractors.

A well-equipped Municipal Asphalt Plant is maintained at a central location, for the manufacture of asphalt mixtures required for the repair of existing pavements and the surfacing of new pavements.

All pavements on which the contractor's guarantee has expired are thereafter maintained by the roadway forces at the general public expense, until they are worn out, when the Local Improvement Act is again invoked for renewal. As of December 31, 1935, the lineal mileage so maintained was 509, comprising 8,454,953 sq. yds. of surface.

For the maintenance of non-bituminous pavements, unimproved roadways and lanes, concrete and wooden sidewalks, etc., a portion of the forces of the

section are organized in two divisions, with a Superintendent and Assistant Superintendent in charge of each. These divisions embrace 11 districts, each with a Foreman, Assistant Foreman, Patrolman, etc., yard and equipment. The main streets of the city are patrolled daily and the remainder twice weekly. The patrolmen report all cuts, sinkages and encroachments on the street allowance, breaches of city by-laws observed, and any other matters requiring attention. Other functions of this maintenance organization are the placing of street name signs and house numbers; cutting of noxious weeds on boulevards and removal of snow from sidewalks opposite vacant lots, from bridges, gulleys, etc., and clearing roadway gutters of snow and ice when necessary.

With the steadily increasing volume of motor traffic, the cindering of grades, street car, and important stop street intersections, has become an operation of considerable magnitude during winter months. This service is maintained day and night. During the winter of 1935-1936, approximately 3,900 separate locations were cindered as required.

Snow removal from streets is another important duty of this section. The work is organized by districts, of which there are thirty-nine. In each is located a shanty at which snow shovelers, seeking employment, report. Experienced employees form the nucleus of each group, which results in added efficiency and economy. By inter-departmental arrangement, the Department of Street Cleaning assumes the task of snow removal from the more important streets in the congested central area, and a portion of thoroughfares more remote upon which the Toronto Transportation Commission (a civic body) operates its lines. At times of exceptionally heavy snow fall, the Street Cleaning Department, in addition to engaging privately owned trucks, withdraws its entire mobile equipment from refuse collection, thereby releasing a large force of men and vehicles for speedy concentration in the main traffic arteries.

The Area and Sign division receives applications and issues permits for awnings, underground areas, gasoline and fuel oil tanks, gasoline pumps, news stands and boxes, illuminated and other signs, occupation of streets for building purposes, concreting of boulevards, etc., and generally deals with all matters of encroachment on the highways. Upon issuance of permits, and from time to time thereafter, inspections are made in order to ensure proper maintenance and public safety. Fees are collected on the foregoing account as provided by law. This division earns a net annual revenue.

The division is notified of all proposed alterations or new work in streets sponsored by the public service utilities. The locations are passed upon as to suitability and inspection is made of the work.

In May 1933, a Public Utility Coordinating Committee was formed, consisting of a representative from the Engineering Department of the Consumers' Gas Company, Bell Telephone Company, Toronto Hydro-Electric System, and Engineers in charge of the various Sections of the Department of Works, under the chairmanship of the Principal Assistant Engineer of the last named Department. A sub-committee was also appointed to make recommendations and report on matters referred to it by the main committee, under the chairmanship of the Engineer in charge of the Roadway Section of the Department of Works. The committee, which meets monthly, deals principally with underground construction of all types on city streets. It decided to prepare plans of the streets, showing the location and elevation of all underground construction.

The work is carried out under the supervision of the Engineer in charge of the Roadway Section, the cost being shared equally by the city and the other three utilities concerned. These plans are drawn to a scale of twenty feet to the inch, and the construction of the various utilities indicated in the color allotted to each.

A survey of surface and sub-surface construction is made by the Roadway Section and a preliminary plan prepared, which is sent to the various utilities to locate their underground work thereon. This preliminary plan is then returned to the Roadway Section and tracing made, from which white prints are taken and colored. These are filed in binders and used as a guidance in locating future underground construction.

An ideal standardized plan has been prepared, in collaboration, covering streets of different widths, whereon is indicated the most convenient location and elevation for various underground services. In future development, this plan should prove of very considerable value.

SEWER SECTION

It is the function of the Sewer Section to deal with all drainage problems, maintain the sewerage system, and operate the sewage treatment plants.

Our sewers generally carry both storm flow and sanitary sewage, constituting a combined system. During storm periods, excess flow is diverted to the lake through a system of storm overflows. A system of separate storm and sanitary sewers is provided for the low-lying areas along the waterfront, from which sanitary sewage is pumped to an interceptor at higher elevation, through which it flows by gravity to the Main Sewage Treatment Works.

The sanitary flow, except that from the North Toronto District, is intercepted and conveyed to the Main Sewage Treatment Works at Ashbridge's Bay via the High Level and Low Level Interceptors. The former carries about three-quarters of the flow entirely by gravity, while the latter conveys the remainder by gravity as far as the plant, where it is elevated by pumping for treatment. Sewage from the North Toronto District falls by gravity through trunk sewers to the North Toronto Sewage Treatment Works in the Don Valley, where after treatment the effluent is discharged to the River Don.

The organization of the Sewer Section embraces four general divisions, *viz.*, Office, General Maintenance, Contract Construction, and Sewage Treatment and Disposal.

The office organization furnishes surveys, designs, and estimates and administers the section in detail. It also supervises construction and local improvement procedure.

For sewer maintenance the city is divided into Eastern and Western Divisions, with headquarters at centrally-located yards. Each Division is in charge of an Assistant Engineer with Superintendent, Foremen, Sub-foremen, etc.

All sewers, manholes, weirs and overflows are periodically inspected. Cleaning, repairs, and flushing are performed as required. Complaints of flooding, obstructed drains, etc., are investigated by this staff. Where combustible gases are suspected or encountered in sewers, investigation is made with special gas-testing apparatus and immediate steps taken to trace, if possible, the origin of such gases and prevent repetition. Private drain services on the streets are installed by the maintenance forces, who also perform subsequent repairs.

Day Labor gangs execute such sewer construction as may be undertaken by the Department apart from that done by contract.

Sewer construction let by contract is supervised by an Assistant Engineer, assisted by qualified Inspectors.

The two sewage treatment plants are under the direct supervision of an Assistant Engineer. They are operated continuously by experienced men working in eight-hour shifts.

The Main Sewage Treatment Plant which serves the entire city, with the exception of North Toronto, is not modern. The administration has procured a complete report from eminent consulting engineers who recommend replacement by a modern system. Financial considerations have delayed action anent this proposal.

The North Toronto Sewage Treatment Plant is of comparatively recent construction. It is of the activated sludge type, with preliminary sedimentation and separate sludge digestion. The plant generally comprises rack house and grit chambers, preliminary sedimentation tanks, aeration tanks, final sedimentation tanks, separate sludge digestion tanks, glass-covered sludge drying beds and a retention chamber for storm water. The effluent from this plant discharged to the Don River is clear and highly purified.

By agreement with the adjacent municipalities of Leaside, North York, and Forest Hill, sewage from certain of their areas contiguous to the city limits is drained to the city system and treated at the North Toronto plant.

The main plant serves a population of approximately 580,000, while that at North Toronto treats sewage from 73,000 people.

RAILWAY AND BRIDGE SECTION

One of the important activities of the Railway and Bridge Section is the construction and maintenance of highway bridges within the city. By reason of the topography of Toronto, these bridges are numerous and some of them quite large. In case of construction of a new bridge, or replacement of an existing structure, this section prepares designs, estimates, and specifications, and supervises construction. A resident engineer is stationed at work of magnitude.

The inspection and maintenance of bridges is directly in charge of the Superintendent of Bridge Maintenance, who directs a force of regular employees which is augmented temporarily as occasion requires.

The engineering and maintenance staffs of the section cooperate with other sections when desired, relative to structural matters in which they specialize.

Another essential phase of the work of this section arises from projects or operations in which the city and steam railways are jointly interested. Grade separation is a case in point. Such projects are subject to order of the Board of Railway Commissioners for Canada, a federal authority whose jurisdiction is final. Generally, these works are designed and carried out by the railways in collaboration with the city. Four main schemes of grade separation have been thus achieved.

In the case of isolated structures separating highway and railway grades, the design and construction is carried out by the city or by the railways, as circumstances may dictate, subject always to authority of the Board of Railway Commissioners for Canada.

In addition to the remaining main line grade crossings, there are many in-

dustrial sidings and spurs along or across city streets. The Railway and Bridge Section maintains a systematic inspection of all tracks located on the streets, including crossing protection, and the railways are notified of any condition that requires rectification in the interests of the city and the public using the streets.

WATER SUPPLY SECTION

The Water Supply Section maintains and operates the Filtration Plant, pumping stations, reservoirs, tunnel, intakes and Marine Plant; designs the underground system; compiles estimates and makes recommendations for water mains which are financed either as capital expenditures, local improvements, or bond or revenue mains. It supervises the installation of mains, fire hydrants, and valves by contract or day labor. It also passes on plans for the installation of mains, etc., in Forest Hill Village, Town of Leaside, Township of York and portions of the Townships of North York and East York, to which water is supplied by the city under agreement.

The source of the city's water supply lies approximately two miles south of the Royal York Hotel, off the south shore of Toronto Island, where two 72-inch steel intake pipes extend into the lake 2,220 ft. and 2,430 ft., respectively, the inlets lying at depths of 42 ft. and 79 ft. below the mean water level of Lake Ontario. Water flows by gravity to shore cribs, from which it is pumped to the Slow and Drifting Sand Filter Plants, where it is purified and treated with chlorine, sufficient to insure sterilization.

After filtration, the water enters a clear water reservoir, and thence flows by gravity through 72-in. and 84-in. conduits, northerly across the island to the south shaft of a tunnel built under Toronto Bay, which is connected to the John Street Pumping Station on the city side. Dechlorination is carried out at this station by the introduction of sulphur dioxide.

From the John Street or Low Level Station, water is pumped through the distribution mains to various districts and to the High Level Station. The pumpage from the Low Level Station in excess of demand is delivered to the Rosehill Reservoir (of open type) and that from the High Level Station to the new St. Clair Reservoir which is enclosed. The former reservoir has a storage capacity of about 33 million Imperial gallons and covers an area of 13 acres. The latter holds approximately 50 million Imperial gallons and occupies an area of 8½ acres. Water is delivered to the reservoirs at times of minimum demand and drawn therefrom at hours of maximum consumption.

The topography is such that it is necessary to divide the city into five pumping districts. District 1 comprises the southerly section of the city and is supplied direct from the Low Level Station. The four upper level districts are served by means of repumpage from the High Level Station. Two booster pumping stations, with two water towers, are also maintained to increase pressure in the outlying districts. Approximately 50 per cent of the entire gallonage is repumped.

Under normal conditions, the pumping equipment is electrically driven, but a steam reserve under banked fires is maintained at both the Low and High Level Stations.

This section is supervising the construction of additions and extensions to the water works system, which will ultimately cost approximately \$14,000,000.

The intake, pumping station, purification plant, etc., are located approximately six miles easterly from the Royal York Hotel, at Victoria Park which adjoins the easterly limits of the city. Supply will be derived from Lake Ontario. The intake tunnel (10 ft. inside diameter), runs easterly 3,300 ft. from the pumping station site, at an elevation 105 ft. below mean lake water level. At the outer end, it emerges by way of junction shaft to the lake floor, from which point a reinforced concrete conduit, with an inside diameter of 8 ft., proceeds easterly for a length of 4,162 ft., giving a total intake length of 7,462 ft. From the pumping station and purification plant, a tunnel approximately 9 miles long and from 6 to 7 ft. in diameter, has been constructed along the waterfront at a general elevation of 105 ft. below mean water level of the lake. The new system, when complete, may be operated separately from, or in conjunction with, the existing plant. Its initial capacity will duplicate that of the present intake, pumping and purification units and, as the city grows, additions may be made at minimum expense to serve the ultimate demand.

At the Low Level Station, which is in the central part of the city, are located steam turbine driven centrifugal pumps for operating the separate high pressure fire system. This system derives a supply of raw water from Toronto Bay. It is possible to raise the pressure to 300 pounds to the square inch in a few minutes, thereby providing the Fire Department with sufficient pressure for fighting fires in the congested central business area.

The Marine Plant consists of tugs, scows (one being equipped with a 15-ton derrick), sand pump and diving equipment, together with a number of smaller units which are used for the transportation of coal, material and supplies to the Island Filtration Plant and to the scene of operations of the inspection plant. Inspection of the intakes laid in the lake, including the new intake at Victoria Park, is made by divers at two-week intervals throughout the year, when possible, in order that continuity of supply may be assured.

WATER DISTRIBUTION SECTION

The Water Distribution Section maintains all city mains, valves, hydrants, services, meters, drinking fountains, etc., and is housed in a modern well-equipped building in the western part of the municipality. There is also a branch office in the eastern district. There are four maintenance districts, *viz.*, East, West, North and Island, with a Superintendent in charge of each of the three first mentioned. All domestic pressure fire hydrants throughout the city are inspected twice monthly.

Continuous emergency service is maintained in the eastern and western districts. Emergency trucks with crews are available twenty-four hours daily for handling calls. The trucks are fitted with valve operating devices for quickly closing and opening valves and the necessary equipment to deal with requirements.

A machine shop is maintained with machinists, meter men, hydrant and valve repairmen, blacksmiths, etc., and an hydraulic press for testing pipes and new and repaired valves, hydrants, etc., installed thereat.

A hydrant truck, with a complement of three men, on two shifts in summer and three in winter, covers outside repairs and thawing of frozen hydrants.

All new and repaired water meters are tested in the meter testing shop.

A shop is operated for the production of and repair of patterns for valves up

to 36 in. in size, hydrants, special fittings, etc., from which castings are manufactured for use by the section.

ACCOUNTING AND PURCHASING SECTION

The Accounting and Purchasing Section is in charge of a Chief Accountant and Purchasing Agent. There are three branches, *viz.*, Accounting, Purchasing, and Testing and Inspection.

The entire accounting for the Department is centered thereat. Accounts and contract certificates are checked and certified prior to audit; general and detail accounts are kept; payrolls are prepared, and statements of appropriations, disbursements, etc., furnished. All purchases necessary for the operations of the Department are (subject to municipal regulation) made by this section and the requisite stores maintained.

May I interpolate that municipal accounting differs from general commercial practice. Civic accounting statements present a story of service rendered, whereas the commercial statement is one of profit and loss. In municipal accounting, appropriations are authorized for specific service. It is therefore necessary that all liabilities, commitments, etc., be recorded against the authorized appropriation in advance of the actual receipt of materials, etc., in order that true standing of the appropriation may be demonstrated. This is a factor essential to proper accounting and control.

All Section Heads are provided with a weekly statement showing the state of their appropriations. By this means effective control of expenditure is established and overdrafts prevented.

The Testing and Inspection branch of the Accounting and Purchasing Section tests and inspects materials and supplies used. Practically all materials used in pavements, sewers and other works are tested and inspected prior to use. An inspection service is maintained for bituminous mixtures at the plants operated by the contractors and the city, respectively. Supplies of oil, paint, coal, etc., for the Works and other civic departments are tested to insure that they conform to specification.

PHOTOGRAPHY AND BLUE PRINTING SECTION

A photographer is in charge of the Photography and Blue Printing Section, which supplies the needs of civic departments and, to some extent, those of public utilities, for photographs, blue prints, etc.

The photographic work consists of recording progress in construction of roadways, sewers, bridges, water works and other civic improvements; picture records of conditions prior to and during the accomplishment of street widenings and extensions; production of graphic records to be used as evidence in claims, lawsuits, prosecutions, etc. Lantern slides and photostats are also made and blue prints of plans are produced as requisitioned.

This section is self-sustaining, and I am convinced that in addition thereto it saves its annual cost many times over by reason of the convincing evidence it delineates.

CONCLUSION

I have purposely refrained from interlarding statistics in the foregoing matter. May I, in conclusion, submit some data, as of December 1935, which may be helpful to a better understanding, *viz.*:

<i>City of Toronto</i>	<i>Square Miles</i>	
Land area	34.0	
Water area	6.6	
Total	40.6	
Population	638,271	
Number of streets	1,814	
Mileage of streets	575	
Paved mileage of streets	542,	or 94% of total
Mileage of lanes	158	
Paved mileage of lanes	43,	or 27% of total
Mileage of sidewalks	905	
Mileage of sewers	762	
Mileage of water mains	724	
Number of fire hydrants	8,328	
Number of water services	139,530	
Number of stop valves	9,941	
Number of check valves	319	
Average daily water consumption	70.8	million Imp. gallons
Water consumption expressed in terms of per capita per diem	111	Imperial gallons
Number of bridges	54	
Mileage of bridges	4	
Number of subways	43	
Number of level crossings	49	
of which 28 are protected.		

DISCUSSION

MR. D. W. GODAT (New Orleans, La.): I would like to ask Mr. Harris what he does to obtain automotive parts, or truck equipment, etc., before the office opens in the morning.

MR. HARRIS: We do our best to anticipate the need. We have a well equipped source of supply and in case the needs cannot be anticipated there is a man available who may give us supplies during the night. If we have to get some particular thing we do not have in stock, we procure it during the night. For instance, back in 1910 when there was an emergency in our water supply, we found it necessary to deliver water by means of carts and we had to get two faucets. We did not have any in stock and could not rouse the hardware people at night, and so our man went down and broke into the store, procured them, and used them.

MR. J. M. BIERY (Jackson, Mich.): In regard to competitive bidding of the Department of Public Works against private contractors, I would like to get some more information. We have had that come up and the contractors raise the question that the maintenance of the work would naturally fall upon the city during the ordinary maintenance by the contractors. Also, if it was estimated wrong, who pays for it? If the contractor makes a mistake he pays for it, but if the city makes a mistake it goes back on the property owners.

MR. HARRIS: That is quite true. If we make an error in not bidding sufficiently high, the law provides that it shall be assessed against the work. On the other hand, though, the rate payer gets the benefit of any saving that is

made, because we do work at actual cost. Say a job is estimated at fifteen thousand dollars and we do it for fourteen thousand dollars, then we charge only the actual cost of the work.

On the other hand, if we are over the amount estimated, then that amount is assessed against the work.

In regard to a maintenance bond, we were in the same position as Jackson for a number of years. We were not empowered under the local improvement law to make any provisions in our tender for setting aside any money for guarantee of maintenance. We went to the legislature a number of years ago and asked for that and the contractors opposed it, strange to say, and they defeated our application. However, that was renewed a few years later and the legislature empowered us to set aside and charge up to the work a reasonable sum for guarantee of maintenance, which was set aside in a separate account for that particular work. It was assessed of course, and the funds were raised with the initial job.

MR. H. E. BRYAN (Rochester, N. Y.): I would like to ask the speaker about the underground occupancy maps he spoke of in his report, drawn to a scale I believe, of one inch to twenty feet. Do those maps cover the entire city in that scale?

MR. HARRIS: Yes, they do. You see the maps are made up in comparatively small sections, but they must be at that scale in order to give sufficient area to get a map that may be readily readable.

MR. BRYAN: Wouldn't that involve several thousand maps?

MR. HARRIS: Yes, it does. It is a very slow process.

MR. BRYAN: In 1933 you found the need of such a map as that combining all of the utilities, the conduits, the manholes, etc., and you are combining all that in what you term an underground occupancy map?

MR. HARRIS: Yes. We are doing that on one map, and may I say we felt the need of it many years before, but we have had an experience that is probably common with you all. We had a lot of men who are in positions as foremen, superintendents, etc., who had grown up from the early days with the work, who did not have the benefit of much education, and who relied mainly upon their heads to carry records of underground work—and it was amazing the way they did it. Over a long period of years we extracted as much as we could from them to put on paper, but even that was insufficient and then we called in the utility companies and combined the both together. They advised us of underground work we did not know about and we advised them of some underground work they did not know about.

MR. BRYAN: Are the steam lines shown on that?

MR. HARRIS: No, as a matter of fact we have not got any steam lines.

MR. E. F. MARTIN (Montclair, N. J.): I would like to inquire if the house connections are cast iron or tile, and who installs them?

MR. HARRIS: The house connections from twenty feet on are installed by the property owner. They are of tile. The drains in the house are cast iron. The installation of the tile is made by the city at the expense of the owner.

MR. H. L. HOWE (Rochester, N. Y.): Mr. Fisher would like to know if you have a civil service commission and if you do, how you work under it.

MR. HARRIS: No, we do not operate under civil service. The head of the Department has the absolute right of engaging and dismissing everybody within the Department, and he is held strictly accountable for results.

LOW COST PAVEMENTS FOR CITIES

GEORGE H. SANDENBURGH*

City Engineer, Ann Arbor, Mich.

IN THIS paper I shall discuss the construction of low cost pavements using bituminous materials.

During the ten-year period of 1920 to 1930 a large yardage of high cost paving was constructed. As this was a boom period, money was plentiful and property owners did not object to paying for high cost pavements, but in spite of the large yardage of high class pavements built, there still remained many miles of dirt and gravel streets with their accompanying dust nuisance. In some cases the dust was laid by means of calcium chloride or sprinkling, and in a great many places not laid at all.

I believe the dust nuisance has done more to develop the low cost pavement than any other factor except relative cost. Dust was laid with light oil and there was as much dust as before, only it was not quite so visible. Dust was laid with a heavy oil and a mat was formed on the street surface which soon developed numerous pot holes, causing the street to become very rough and making it necessary to scarify the surface every few years. Calcium chloride next appeared on the market as a dust layer, and it did lay the dust if applied often enough and in sufficient quantity. Laying dust with calcium chloride is a continual drain on the city budget, there is little cumulative effect, and the applications have to be made year after year with no lasting benefit.

Low cost bituminous pavements may be divided into three classes according to methods of construction, namely, surface treatment, road-mix and plant-mix. The material used may be tar, asphalt emulsion, cut-back asphalt, or an asphaltic oil. These three types of low-cost pavements are classified as to cost in the same order, surface treatment being the cheapest, road-mix being more expensive, and plant-mix being the most expensive.

PLANT-MIX

The plant-mix method of low cost pavement construction has never been used in Ann Arbor for the reason that the city does not own an asphalt plant. I am of the opinion that we would be using this method of construction if the city had owned an asphalt plant in 1931 when construction of low cost pavement was begun.

The city of Lansing, Michigan, has been using the plant-mix method of low cost pavement construction with very good results for the past five years.

They use an asphaltic oil for the bituminous material. The grading of the plant-mix is closely watched to keep it within the following limits:

Passing 1-inch screen, circular openings	100%
" 1/4- " "	50-80%
" No. 10 mesh "	35-70%
" No. 200 " "	5-15%
Asphaltic road oil	5%

The aggregate for the plant-mix is obtained from a city-owned gravel pit and

* Paper read by Herbert A. Olson, Michigan Municipal League, Ann Arbor.

is charged to job at \$1.00 per cubic yard. Ten-mesh sand and silica dust are added to the bank run material in order to bring the grading within the limits given in the preceding paragraph. Five per cent of silica dust is added to the pit material which, along with the 2 per cent of No. 200 mesh in the pit aggregate, gives an average of 7 per cent of No. 200 mesh material.

Asphaltic Oil Specification

100 Penetration asphalt content	72-80%
Ductility of asphalt content @ 77° not less than	100
Specific Gravity @ 60° not less than	1.02
Soluble in Carbon Disulphide not less than	99.0%
Flash Point (open cup) °F. not less than	225°

Distillation Test, per cent by volume

Total Distillate to 437°F. not more than	2%
" " " 600°F. " " "	10%
" " " 680°F. " " "	20%
Furol Viscosity, seconds @ 122°F.	350—850
Furol Viscosity, seconds @ 140°F.	150—300

All materials are separately weighed and mixed in the same manner as a sheet asphalt mixture. The asphaltic oil is heated to 160°F. The gravel is heated in a revolving dryer to remove the moisture content to less than 1 per cent.

The plant-mix material is hauled in trucks to the street to be paved, dumped on the prepared subgrade, and leveled with power graders to a uniform thickness of three inches. When cool, the mixture is rolled with a ten-ton tandem roller. The street is then rolled once a day for three or four successive days during the cool part of the day.

Maintenance of these streets during the past five years has been reported as negligible. However, the streets are given a seal coat during the fourth year. Due to raveling along the edges, streets are not paved unless they are curbed or curbed and guttered.

No street is paved unless it has a well compacted gravel surface six inches in thickness. Nine tests for thickness of gravel are made in each block, and if one or two tests show a thickness of gravel of less than four inches, the street is rebuilt. Before applying the plant-mix material, the street is excavated to grade and contour to a depth of two and one-half inches below the gutters and then rolled with a ten-ton three-wheeled roller.

The cost of materials going into the plant-mix have been given to me as follows:

Gravel	\$1.00 per cu. yd. at mixing plant
Silica Dust	\$5.25 per ton
Asphaltic oil	4.93 cents per gal.

Equipment rental is charged to the project according to Michigan State Highway standards. Common labor is paid 62.5 cents per hour and skilled in proportion.

The cost of the completed pavement for 230,000 sq. yd. built in 1935 was 32.5 cents per sq. yd.

Mr. Sam Jacka, City Engineer of Lansing, reports that these pavements are proving very satisfactory and recommends them highly for residential streets. He estimates their life as from fifteen to twenty years, provided a seal coat is applied every four or five years.

SURFACE TREATMENT

From 1920 to 1930 we used calcium chloride for a dust layer in Ann Arbor and spent as much as \$22,000 per year for laying dust with this material.

In 1927 our Board of Public Works decided they would experiment with some other type of dust layer in the hope of obtaining something of a more permanent nature. We had been maintaining our pavements for ten years previous to 1927 with Tarvia with very good success and naturally used Tarvia in our experiment.

A street about a half mile long in the residential section of town was selected for the experiment. The subgrade on this street was sand, and concrete curb and gutter had been built and the street graded and graveled a few years before. It was decided to give this street a bituminous surface treatment using Tarvia. The following method was used:

The dust and loose material were swept off the surface of the street with a tractor-driven rotary broom. One-third gallon of Tarvia "B" per square yard was then applied to the surface and allowed to penetrate into the surface for a period of twenty-four hours, then another application of one-quarter to one-third gallon of Tarvia "B" was applied and immediately covered with sixteen to twenty pounds of pea pebbles per square yard. The surface was dragged with a brush drag and then opened to traffic. This street was given a seal coat of Tarvia "A" in the summer of 1928 and another seal coat in 1930. These seal coats consisted of one-fourth gallon of Tarvia "A" and sixteen to twenty pounds of pea pebbles per square yard. This street has had no maintenance of any sort since 1930 and is in very good condition at the present time after six years of service.

Due to the success of our experimental street, we started a big program of low cost bituminous pavement construction in 1931. Three of the streets paved in 1931 were of the road-mix type and the balance of the surface treatment type. When costs were computed for our 1931 work, we found that there was only a fraction of a cent difference in the cost of the surface treatment type and the road-mix type. The cost was 12.8 cents and 13.5 cents respectively. To sweep the dust and loose material from the surface of the street, picking it up and hauling it away, cost as much as the mixing in the road-mix method. We were very much surprised to find that the road-mix method cost only seven-tenths of a cent per square yard more than the surface treatment, and inasmuch as the surface treatment gives a wearing surface about one-half inch in thickness and the road mix a wearing surface from one and a half to two inches in thickness, we have adopted the road-mix method as a standard.

ROAD MIX

Of course you are all familiar with the road-mix method of low cost pavement construction. It means that the bituminous material is mixed with the surface material on the streets by means of power graders.

If the street to be paved is a well graveled street, with a depth of gravel

of six inches or more, the surface of the street is scarified to a depth of one and one-half inches and one-half gallon of tar per square yard applied uniformly to the street surface. The tar and loose material are then mixed by means of power graders until the tar is uniformly distributed throughout the gravel. This mixing will take from six to twelve turnings, depending on weather conditions. When thoroughly mixed, the material has a uniformly black color. After being thoroughly mixed, the bituminous mixture of tar and gravel is spread evenly across the street and another application of three-tenths of a gallon of tar per square yard applied and then bladed again by the power graders until thoroughly mixed. After the second mixing is completed, the mixture is leveled off to the grade and contour of the street and rolled with a five-ton three-wheeled roller. The street is then opened to traffic and after curing for a period of two weeks or more is given a seal coat of one-quarter to one-third gallon of tar TM-2 and immediately covered with sixteen to eighteen pounds of pea pebbles per square yard, and again rolled with a five-ton three-wheeled roller. The next year a second seal coat is applied, the same as the first year's with the exception that the bituminous material is tar TH-1, cut-back asphalt RC-3, or asphalt emulsion AE-3.

If the street to be paved has not been well graveled, or if the material in the street surface is fine, from an inch to an inch and a half of pebbles passing a one-inch screen is added to the surface of the street, the procedure after adding these pebbles being the same as described in the preceding paragraph.

Equipment: The equipment used in constructing these low cost pavements other than that usually owned by the average city is: One 1000-gallon South Bend motor driven bituminous distributor, two Austin one-man power graders; one five-ton three-wheeled roller and two 12,000 gallon storage tanks, heating boiler and pumps. If purchased new this equipment will cost approximately \$15,000.

Materials: The tar used for the road mix and the first year's seal coat is Michigan State Highway Specification Tar TM-2. The bituminous material used for the second year's seal coat is Michigan State Highway Specification tar TH-1, cut-back asphalt RC-3 or asphalt emulsion AE-3.

The stone added to the surface of the street meets the following specification:

Passing one inch sieve	100%
Passing one-half inch sieve	25 to 60%
Passing one-quarter inch sieve, not more than	10%

The pea pebbles used for covering the seal coat have the following sieve analysis:

Passing one-half inch sieve	100%
Passing three-eighths inch sieve	75 to 85%
Passing one-quarter inch sieve	20 to 35%
Passing #8 sieve, not more than	3%

Costs: The cost per square yard of low cost road-mix bituminous pavements is itemized as follows:

Tar	10.654 cents per sq. yd.
Stone	2.893 " " "
Pea Pebbles	.644 " " "
Miscellaneous	.220 " " "

Labor	3.161	"	"	"
Equipment Rental	1.978	"	"	"
Engineering & Supervision 3%	.551	"	"	"
Total Cost	20.101	"	"	"

The cost of the second year's seal coat is itemized as follows:

Tar	3.28	cents	per	sq. yd.
Pea Pebbles	.79	"	"	"
Miscellaneous	.01	"	"	"
Labor	.75	"	"	"
Equipment	.26	"	"	"
Engineering & Supervision	.30	"	"	"
Total Cost	0.539	"	"	"

The second year's seal coat is considered as part of the original cost, making the total cost of this type of low cost pavement slightly under 26 cents per square yard.

The above costs are based on the following wage rates:

Common Labor	.50	per	hr.
Grader Operators	.60	"	"
Truck Drivers	.56	"	"
Distributor Driver	.60	"	"
Distributor Operator	.56	"	"

The following hourly rates are charged for equipment rental:

Distributor	\$2.76	per	hr.
Two yard Trucks	.75	"	"
Power Graders (average)	.86	"	"
Five-ton Roller	.66	"	"

The per square yard cost of road-mix low cost bituminous pavements is based on the following unit prices paid for materials.

Tar per gal. f.o.b. Ann Arbor	.945	cents
Stone per cu. yd. on the street	\$1.45	
Pea pebbles per cu. yd. on the street	\$1.45	

Of course these pavements are not a cure-all. For best results they should have four to six inches of compacted gravel below the bituminous wearing surface.

These low cost pavements are built on petition of the property owners. The city at large pays 100 per cent of the cost of street intersections and 20 per cent of the frontage cost.

Every year we have petitions for more pavements than we can build with our equipment. Our residents say it is the best public improvement ever undertaken by the city. The first pavement built is now nine years old and at present is in a good state of repair. From our experience we have reason to believe these pavements will have a life of from ten to fifteen years or even longer. When a pavement such as these can be built at an initial cost of 26 cents per square yard, no city should be without paved streets.

There is no way of calculating the value of these pavements to the health

of the residents of our city, in preventing colds and other diseases of the respiratory system, by eliminating the dust nuisance.

The only complaint that I receive on these pavements from our residents is, "Why didn't you start building these low cost pavements ten years ago? Then the pavement on my street would have cost me 40 cents per front foot instead of the six dollars per front foot that I paid."

Maintenance costs during the past five years have been very low. We spent \$2,950 for maintenance on the 498,700 sq. yds. in service during the 1935-36 fiscal year.

I have described three methods of constructing low cost pavements in cities. Any one of these methods will give satisfactory service. If the street to be paved is well graveled with a smooth surface of proper contour from curb to curb, a surface treatment will give excellent results at a cost of approximately 19 cents per square yard. If the street to be paved is not well graveled and if the surface is not smooth and of proper contour and needs rebuilding and the addition of new gravel to bring it to the proper grade and contour, then this rebuilding should be done and the surface thoroughly rolled until compacted and the wearing surface then applied by the road-mix or plant-mix method.

DISCUSSION

MR. S. SHUPE (Kitchener, Ont.): Presumably the amount reported does not include gutters. We find for city streets the low cost pavement can be prolonged indefinitely, but in the absence of curb and gutter there are some desirable statistics to be obtained, and I would like to have Mr. Olson elaborate on the curb and gutter to make the street have a different appearance.

MR. OLSON: From my experience with graveling it seems to vary somewhat with the type of materials used in the construction of the pavement. In Michigan, of course, the whole country is a clay and gravel till and we find that in the use of this low cost type of construction by county road commissions, where they are going up and down hill and across the country and building up this type of construction over various types of sub-base, that the graveling varies with the type of sub-base. On a clay sub-soil it seems to gravel considerably more than on a gravel sub-soil and there seems to be a difference of opinion as to whether cut-back asphalt, emulsion, or a tar will gravel more quickly. I am not prepared to give any opinion as to the relative merits of using asphaltic oil, cut-back, or tar, but Mr. S. Jacka up in Lansing has used asphaltic oil very successfully and economically, and Mr. Sandenburgh has used Tarvia almost continuously and there is a continuous argument when they get together as to which is the better. I think the only conclusion that can be drawn is that they are both good, but require different methods of handling.

MR. HARRIS (Toronto, Ont.): Did I understand you to say 75 cents an hour for the truck, which does not include the operator? That would mean 75 cents plus 56 cents for the operator or a total of \$1.31.

MR. OLSON: The Ann Arbor Works Department has a unit cost record system that was suggested by Public Administration Service. They had been keeping a cost record on all their equipment for several years prior to the installation of this system of unit cost records, and they feel that the costs which they set up are just about right. I don't know how many pieces of equipment the Public Works Department has, but in their revolving equipment fund

they are building up a little extra every year. I suppose in some years they go into the hole on certain pieces of equipment and then they gain a little on others, but I do know that those records were prepared very carefully, and I think they represent very nearly the cost of operating the equipment, and it includes all operating expenses with depreciation, etc.

MR. HARRIS: Does that include gasoline?

MR. OLSON: Yes, everything.

MR. ROSENGARTEN (Ardmore, Pa.): Michigan is far enough north to experience freezing, and I would like to know if they have any difficulty with frost in this type of construction?

MR. OLSON: These pavements have not worked out entirely satisfactorily on a clay base. You do have to do some patching in the spring after the frost has come out of the ground. However, those repairs are very inexpensive because you can go out and take a little material and patch it up and it is just as good as it was, and the cost is very low. Out in the country or on the rural route system, and particularly in the northern part of the state, boils are quite prevalent. This spring break-up condition is one of the reasons why the State Highway Department has gone rather slowly in the construction of this type of pavement.

MR. H. L. HOWE (Rochester, N. Y.): Are you building these streets in the residential districts that are carrying the heavy buses, or are you limiting them to the loads put on them?

MR. OLSON: This type of pavement is used primarily for the residential streets. Mr. Sandenburgh, I am sure, would agree that the low cost pavement is no substitute for the high cost pavement on heavily traveled streets, but we find that between seventy and seventy-five per cent of all of the street mileage in the average municipality is of this residential type and the total saving to the municipality of this type of construction is very great in comparison with the uniform construction of high class pavement throughout the street system.

I think that I failed to answer entirely the question of the gentleman from Kitchener. He asked about the graveling and I only partially answered that. However, in all the cities where this type of construction is being used, we advocate that curbs and gutters be constructed first.

MR. S. SHUPE (Kitchener, Ont.): What is the width of your roads, and what crown do you use?

MR. OLSON: I could not tell you. The specifications vary from county to county. The crown is quite a bit more than the concrete pavement, but every year the specifications are being revised and the matter of crown provided for. The engineers were a little afraid of one type of construction that was first instituted, and they gave quite a heavy crown to the road, but they are getting away from that and constructing it with comparatively flat crowns. In the municipalities we are using about the same type of crown as we do on asphalt, concrete, or brick.

MR. W. B. SHAFER: Do you give your county roads any special treatment?

MR. OLSON: Generally speaking, the gravel surface before the roads are built is more than twenty feet wide and so, in constructing these roads twenty feet wide, we still have a little gravel before we get to the grass. Most of the county road commissions now are trying to keep grass on the side to prevent wash-outs.

MR. H. W. GODAT (New Orleans, La.): The gentleman remarked that the

gutters and the curbs were laid first. Is that paid for by the property owners or do you have to add that to the cost of the street?

MR. OLSON: A good many of the streets, even though they are gravel streets, have curb and gutters. In a few places in the older parts of town they have the straight curb. Where the curb is already in they try to get along without disturbing that curb and gutter, although there are in all municipalities some places where the grades that were established fifteen or twenty-five years ago would not be sufficient to take care of the needs of today, but they try to leave it alone as much as possible. Wherever a street does not have a curb and gutter, they endeavor to have that constructed before the paving surface is laid, and in Ann Arbor it just so happens, as Mr. Sandenburgh said in his paper, that the demand for this type of construction exceeds their ability to keep up with the program. So, whenever a property owner wants a street and asks that it be surfaced, Mr. Sandenburgh generally tells them that they can very easily get to curbing and guttering that street this year, but it is impossible to take care of the pavement, and if they don't have the pavement for one or two years, they generally do have the curb and gutter, so then they can get at the pavement whenever possible.

MR. GODAT (New Orleans, La.): Does the city pay for the curb and the gutter?

MR. OLSON: No, the property pays for that by and large. The city pays for the intersections and the city may stand a portion of the curb and gutters. I am not sure about that but it does vary materially from city to city in Michigan.

CHAIRMAN BROWN: Are there any further questions on that paper?

MR. J. E. DORAN (Bridgeport, Conn.): I hoped there might be a certain type of pavement mentioned in this paper that Mr. Olson just gave. I came down specially to find out if anybody had had any experience in building foundations, stabilized foundations, with emulsified asphalt with some kind of a wearing surface. Has anybody any experience with that?

MR. L. F. PECK (Hartford, Conn.): Hartford is just experimenting with the emulsified sub-soil. However, we have not had any experience with it as yet.

MR. DORAN: Was that in the city, town, or in the country?

MR. PECK: In the city and with airport runways.

MR. G. C. STANLEY (Burlington, Vt.): We have had some experience with that on our airport runways and also on some of our residential streets over a period of three years. We have had very good success with it, and it is about the same cost as Mr. Olson mentioned for Ann Arbor. There is possibly a little greater cost per square yard for the finished pavement because of the price of our stone which is a little higher than most places.

We have built two runways on our airports with a surface 2,500 ft. long and 100 ft. wide with drainage on each side. We used the American stabilized emulsion four and one-half inches in depth. We used about one gallon of emulsion per square yard. It is put on in four applications of a thorough mixture of three gallons of water to one of emulsion, making four applications to one square yard. It is then rolled and graded, and on top of that is put one and one-half inch top coat using one gallon of emulsion in it. Some of that work has been in for two winters or three seasons, one runway has gone through two seasons but only one winter, and we have several residential streets which have gone through two and three seasons. We have one built on a grade of

about ten per cent. It was started last year and we got caught in a snow storm and we had to plow the snow off the job before we could complete it. That was about last Thanksgiving. That might be foolish, but we were going to try anything once and we put the snow off and completed the project which is about 2,000 ft. long, but we did not seal it. We gave it only one application. The day before I left to come here, we flushed that street completely and found we only had one small break of about a foot in diameter at the point where the grade changed on a curb, and that was apparently due to dirty material. That was the only break in the whole surface, and it had only one application of penetration of the top coat. That was done about the first of December. We used a cut-back, however, in that penetration. We expect to do something with that this coming week.

We are using the same methods on several other streets to very good advantage and with very good success. The unit cost has been less than fifty cents for the total cost of four and one-half inch stabilized base and one and one-half inch top coat.

MR. PECK: Was there any subgrading connected with that?

MR. STANLEY: On the airports we had the drainage on the shoulders of each runway, using the corrugated metal pipe construction laid about four and a half feet below the surface and just outside of the edge of the pavement. That was the only grading we had on the airport, but we had a catch basin inlet every 250 ft. on each side.

On the residential streets, of course, there have been sewers and water works, gas, etc., installed in all of the streets which gives a more or less porous condition to the sub-soil, and some of those were on clay and some were on sandy sub-soil. This one that I spoke about putting in during the winter was on a clay sub-soil, but it had a fairly good foundation of crushed stone and some large size stones which were blasted off during the installation of sewers, etc.

DEVELOPMENTS IN MUNICIPAL ROAD SURFACES

H. F. CLEMMER

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DESIGN and construction of efficient road surfaces for carrying the enormous vehicular traffic of the present day has made slow but steady advancement during the past few years. It is therefore of interest and value to correlate the various factors of design and construction from which these improvements have resulted.

As a result of more definite control of standards for road design and construction by the federal government in the administration of federal aid funds, state highway departments are, in general, more advanced in their specifications for economical and efficient construction of pavements than are municipal organizations. However, the recent cooperation of the federal government through the state departments, in constructing main thoroughfares in municipalities has been an important factor in raising municipal road construction standards.

Probably the outstanding advancement in highway research work since the development of a rational method of design of rigid type pavements, has been the development of methods of tests for identification of soil characteristics and proper methods for treating and stabilizing these soils to effect maximum bearing power.

The proceedings of this Society offer modern specifications for concrete, brick, and bituminous pavements, and it is hoped that suitable specifications for stabilization of soils for low cost roads, for high type pavement subgrades, and for fills of all kinds will soon be made available. The added cost necessary to properly treat soils to obtain maximum service is of minor significance when considering resulting benefits. This subject will be discussed more fully later in this paper.

Reference was made to the high standard of state road building resulting from the influence of the federal department of roads. This Society offers an excellent clearing house for developments in highway design and construction by municipal engineers and it is with the idea of stimulating discussion, with the hope it will culminate in definite recommendations, that this paper is presented.

CONCRETE PAVEMENTS

For more than a decade the design of the rigid type pavement has been based on a rational formula. Seldom, however, have actual conditions under which the pavement is to be constructed and the volume and type of traffic been given proper consideration in this design. Too often engineers follow general assumptions and thereby do not secure the maximum in economical service from an investment. The building of highways is a business of enormous proportions and is deserving of the most careful economic study.

Our first thought in designing any engineering structure should be the foundation. In the past our knowledge of subgrade soils has been so limited that no definite subgrade support has been considered in the design of

pavements. Recently this rather neglected highway construction detail has been receiving prominent consideration, due, undoubtedly, to the foreseen adaptability of stabilized soil roads as ideal bases for higher type pavement surfaces. Although the use of the corner design formula for rigid type pavements, disregarding definite subgrade support, has proved to be an adequate design standard, the possible economy of using a thinner concrete section than ascertained from this formula, when utilizing subgrades of high bearing value, is worthy of consideration. High supporting value is likewise applicable to the construction of flexible pavement surfaces.

Future design standards for the development of road programs will undoubtedly follow more or less the stage construction plan in that the initial procedure will be to construct uniform and dense subgrades (which may be temporarily used for road surfaces), rather than to permit the mere shaping and superficial rolling of existing subgrades as is the present general practice. Methods developed for the construction of stabilized soil roads can be readily adapted to the construction of bases for higher type pavements. Such methods have, in fact, been adopted as standard practice by several state highway organizations for construction programs inaugurated this past year. To illustrate the practicability of improving the supporting value of subgrades through proper combination of cohesive and granular materials, the following table is quoted from data reported by the U. S. Bureau of Public Roads:

INFLUENCE OF INTERNAL FRICTION AND COHESION UPON STABILITY OF SOILS

Soil Types	Cohesion <i>lb./sq. ft.</i>	Angle of Internal Friction <i>degrees</i>	Supporting Value ¹ <i>lb./sq. ft.</i>
Clay, liquid	100	0	400
Clay, very soft	200	2	860
Clay, soft	400	4	1,850
Clay, fairly stiff	1,000	6	4,970
Clay, very stiff	2,000	12	12,490
Sand, dry	0	34	270
Cemented sand and gravel	1,000	34	17,340

A more detailed discussion of the principles involved in stabilization will be presented in a later section. The foregoing is presented merely to show the economic advantage of improving subgrade support.

CROSS-SECTION

It is a simple matter to determine the required slab strength so far as super loads may be concerned. Very definite information is available on strengths obtained by various concrete mixes and the most economical mix for the materials to be used may be readily determined. It is important that the concrete be designed for durability; that is, that the unit cement content be sufficient to insure maximum durability. The required thickness of slab will, of course, depend upon the unit strength of the concrete.

¹Computation based on assumptions that weight of the soil equals 100 pounds per cubic foot and width of loaded area equals 3 inches.

An analysis of the stresses in a concrete pavement, presented by Professor Westergaard, as well as definite field tests and actual service, has demonstrated that the edge thickness should be greater than the center of the pavement slab. Shortly following the construction of the original sections of the Bates Road Experiment, additional sections were constructed with the thickened edges which decreased to that of the mid-portion at a distance of two feet from the edge. Results of service tests on these sections proved the value of this design. It has become rather general practice to reduce the edge thickness to the required center thickness within three feet of the edge. Recent tests by the Bureau of Public Roads on distribution of super loads to secure uniform stress in the pavement slab corroborate the design used in the Bates Road sections, in which this distance was two feet.

Many municipal engineers prefer building but one lane (10 feet in width) of pavement at a time and have considered it more practical to construct a slab of uniform thickness. Certainly practical tests have shown the value of the thickened edge design, and the fact that it applies to a pavement width of only 10 feet is illustrated by these recent tests made by the Bureau of Public Roads, indicating that the increased thickness may be reduced within two feet to the required center thickness. In lieu of an 8-inch uniform slab, a 9-6-9 slab would without question be a more balanced design.

EXPANSION AND CONTRACTION JOINTS

The proper design and installation of expansion joints is probably demanding as much attention at the present time as any one factor in the design and construction of rigid type pavements.

The phenomenon that concrete expands and contracts due to temperature and moisture changes has long been known, but full consideration has not been given, in the design of rigid type pavements, to the effects of the stresses resulting from these volume changes.

In 1934 the Bureau of Public Roads, realizing the definite importance of relieving stress due to confinement of concrete in pavements, issued a memorandum requiring the use of expansion joints in all concrete pavements constructed under their supervision. Briefly this memorandum requires that:

Expansion joints be used at intervals not greater than 100 feet

Provisions be made for load transfer across expansion joints (For three-quarter inch dowel bars a spacing of 12 inches is recommended.)

Provision be made for crack control between expansion joints by the use of steel reinforcement, or suitably designed transverse contraction joints, or planes of weakness, so that distance between joints will not exceed 30 feet.

As yet no memorandum requiring joints for concrete bases has been issued by this Bureau.

In previous years some state highway departments constructed extensive mileages of concrete pavements without expansion joints, assuming that "blow-ups," caused by excessive stress of the concrete due to expansion, could be repaired more economically than expansion joints could be installed at regular intervals. However, research has shown that repeated loading of the concrete beyond a certain elastic (or endurance) limit, causes definite fatigue of the concrete, and it is probable that a far greater area of pavement concrete was over-stressed than would be replaced in repairing "blow-up" sections.

The report of the Illinois Highway Department showing that the number of "blow-ups" is progressive with the age of the pavement confirms this assumption.

The design of rigid type pavements by the use of the so-called corner design formula, taking into account definite super-loads, has proved through experience to be adequate, so far as the cross-section of concrete is concerned. However, a more durable and serviceable pavement would be obtained if definite consideration were given to the stresses in concrete caused by expansion or contraction and curling due to temperature and moisture changes.

The function of an expansion joint is to insure free movement of the concrete under expansion. The amount of space needed may be easily estimated and it should be determined according to the conditions at the time of construction. For example, the maximum temperature range is greater when construction is carried on during low temperatures, and greater expansion space should therefore be provided for pavements constructed during the winter months. Assuming a possible temperature range of 100° F., and the coefficient of expansion of concrete as .0000055, the expansion for each 100 feet of pavement would be .66 of an inch. The construction, therefore, of an expansion joint of one inch effective width, allowing 50 per cent as much for the effect of moisture as for temperature changes or movement, would, without doubt, insure against stress being caused by confinement of the concrete during variations in temperature and moisture conditions.

It is necessary, however, to consider the effect of contraction of concrete resulting from temperature and moisture changes. Were joints to be spaced as far apart as 100 feet, the stress created at the time of maximum contraction might well exceed the tensile strength of the concrete, and cause the formation of transverse cracks which cause definite slab weakness. It is necessary, therefore, in order to control cracking, to provide intermediate joints so spaced that stress caused by the movement of the pavement slab does not exceed a safe working limit based on the strength of the concrete.

An additional factor creating stress in pavements results from curling of the slab. During the Bates Road studies it was realized that the stress set up by curling was a contributing factor in the longitudinal cracking of pavements, and for this reason the installation of a center longitudinal joint in pavements of 18 feet or more in width has become universal practice. Tests recently reported by the U. S. Bureau of Public Roads confirm the findings of the Bates Road studies in regard to minimizing warping stresses through the introduction of longitudinal joints. Further, as is to be expected, the reduction in slab length likewise reduces warping stresses. The table on page 64 is taken from the work of Teller and Sutherland presented in *Public Roads* November 1935. As reported by the authors, "The average reduction in the critical warping stress caused by the decreased slab length (from 20 to 10 feet) is approximately 66 per cent in the interior of the slab and 89 per cent at the point near the free edge."

Determinations as to the amount of stress that may be set up by curling of the slab indicate that for a 20-foot length of concrete slab it may equal that caused by the legal design super loads. It is more important, therefore, that engineers take this stress into account and consider the value of reducing slab lengths in order to decrease this possible stress.

Consideration should be given to the fact that if the space between joints is

OBSERVED LONGITUDINAL WARPING STRESSES IN 10- AND 20-FOOT SLAB LENGTHS

DATE 1934		MAXI- MUM AIR TEMP. °F.	MAXIMUM LONGITUDINAL WARPING STRESS				REDUCTION IN STRESS FROM DECREASED SLAB LENGTH	
			Interior 20-foot length lbs./sq. in.	10-foot length	20-foot length	Edge 10-foot length lbs./sq. in.	Interior Per cent	Edge Per cent
Apr.	26	68	307	132	.	.	57	
May	1	74	376	142	.	.	62	
	2	71			121	68	.	44 ¹
	13	83	287	81			72	
	14	90			278	21	.	92
	28	83	429	151			65	
June	1	90			354	46	.	87
	11	94				38	.	87
	14	88			313	20	.	94
	15	94			252	19	.	92
	21	101	451	132	.	.	71	.
	22	96	414	130	.	.	69	.
	25	97			283	51	.	82
						Average	66	89

¹ Not included in the average.

sufficiently close, the movement at any expansion joint or plane of weakness will be but slight, and it might not be necessary to require special provision for transfer of load if the dummy type of joint is constructed where a plane of weakness may be desired. Provision must be made, however, for load transfer across all other transverse joints. The use of dowel bars requires special care and properly designed supports to insure satisfactory installation. Where dowel bars are used, the joint and dowel bar assembly must be installed in a rigid unit to prevent displacement by workmen or otherwise during construction. There is an alternate type of dowel which consists of a comparatively short close-fitting bar acting between two anchored and reinforced bearing sleeves. This load transfer unit is much easier and more satisfactory of placement and has proved to be efficient in the transfer of load.

Load transfer may also be effected by the use of a form making a key joint in such a manner that one slab is keyed into the adjacent one. It is difficult to insure proper placement of the concrete when installing this type of joint, and it is advisable to require the use of an internal vibrator.

As has been stated, the spacing of expansion joints of one-inch width at 100-foot intervals would provide adequate space for expansion of the concrete, and properly spaced contraction joints (planes of weakness with provision for transfer of load) would control transverse cracking due to contraction of concrete. However, the wider the expansion joint, the less efficient is the load transfer with the dowel type of construction. It is therefore desirable to design expansion joints of not more than one-half inch width and with contraction joints in between these expansion joints so as to reduce the length of pavement slabs to not more than 20 feet.

The temperature at the time of placing the concrete must be taken into account for the proper and economical spacing of joints.

REINFORCING STEEL

The use of reinforcing steel in the construction of concrete pavements has become quite general. Approximately forty-four state highway departments make use of reinforcing steel in some manner. Its use for pavement construction is not to add structural strength to the slab, as is its purpose in other types of structures, but to control cracking. It would be impracticable economically to use sufficient reinforcing steel to develop added beam strength in a pavement slab.

In pavements without reinforcing steel to hold the concrete intact, the occurrence of cracks in the center section of the slab causes free edges; this condition permits each section to expand and contract independently. Where a crack develops in the interior of an unreinforced slab, between the thickened edge sections, progressive failure could be expected since a free edge would then be created at a point not designed as such. In the case of reinforced slabs, however, the concrete is held together so that any cracks, whether incipient or perceptible, are bridged and free edges are eliminated.

One of the most important benefits from the use of well distributed reinforcing steel is the control of shrinkage stresses during the setting of the concrete. It is of interest to report on the use of small mesh (chicken wire) placed around all permanent structures such as manholes, etc., in the District of Columbia. The formation of radial cracks around manholes and similar structures presented not only an unsightly appearance but an actual structural weakness. It was found that the installation of approximately two yards square of such wire prevented the localizing of shrinkage stresses during setting of the concrete and eliminated cracking.

Without doubt, reinforcing steel placed in concrete pavements tends to distribute stresses developed during setting of the cement and to minimize the formation of incipient cracks which may later develop into major failures.

With a trend towards shorter and smaller slab areas there may be an equal reduction in the weight of reinforcing steel specified. This trend is further substantiated by the findings of a committee of the American Road Builders' Association on "Design and Construction of Concrete Highways," 1932, concluding as follows:

"Reinforcing was found to have no material influence on the ultimate uncracked slab length. There is some indication that at the earlier ages the crack interval on reinforced pavement was longer than in comparable plain pavement, but increasing age there was no difference in the ultimate uncracked slab length. Observations show, however, reinforcing does hold the sections adjoining the cracks tightly together."

For all concrete pavements in the District of Columbia of less than 40 feet in width, a 20-foot center section with a thickened edge and center longitudinal contraction joint is constructed. Side sections of whatever width of roadway is permitted are tied onto the middle section with $\frac{1}{2}$ inch diameter bars of 3-foot length spaced 5 feet apart. The edge adjacent to the center section is thickened to equal that of the center slab and the curb and gutter are constructed integrally to eliminate the need for thickening the outside edge.

Bituminous impregnated paper is used to cover all subgrades before placing of concrete. The use of this covering, which is negligible in cost, has proved of value in controlling the consistency of concrete, and permits the use of a much drier mix. Variation in absorptive characteristics of different types of

subgrade causes definite variation in the consistency of the concrete unless the subgrade is covered with some moisture proof material.

Mesh reinforcing steel weighing 50 pounds per 100 square feet is used in the construction of all concrete pavement.

Expansion joints of the metal air-cushion type, using either dowel bars or the formed keyway for transfer of load, are installed at 40-foot intervals when concrete is placed at temperatures of 55° F., or below. When the temperature at the time of construction is over 55° F., the expansion joints are placed at intervals of 60 feet, with contraction joints at midpoints, using the same design for transfer of load and sealing at surface as the expansion joints. The expansion joints are $\frac{1}{2}$ inch in width rather than the usual 1 inch, to effect more efficient load transfer. Where dowel bars are used they are spaced at 12-inch intervals. All concrete road surfaces are finished by lightly drawing a street broom over the surface after final belting. This finish not only has a pleasing appearance but affords maximum traction and minimizes glare.

Specifications on protection and curing of concrete require the covering with layers of saturated burlap or the surface application of calcium chloride.

A factor of first importance in the construction of municipal pavements is the necessity for early opening of the pavement to traffic. Specimens of concrete are made daily on each project constructed in the District of Columbia, and tested by field representatives. As soon as the results indicate that the design strength has been attained, that portion of the project is immediately opened to traffic.

Special study has been carried on to determine the most efficient methods of obtaining early strength concrete. As an intersection is approached an accelerator is incorporated in the concrete mix for the last day's construction so that section will be ready to open at the same time as the concrete previously poured. Intersections are generally poured with a mix containing one extra sack of cement per cubic yard as well as the accelerator. This practice permits the opening of pavement within 24 hours and in many cases the pavement has been opened to traffic in as short a time as 8 hours, but never until the field tests of specimens from the same concrete have certified that proper strength has been attained. This practice has been found to offer the most practical and economical means of obtaining early-strength concrete.

Several years of experience in making field strength tests on concrete have shown that the development of early strength is considerably retarded when concrete is placed while the temperature is 50° F., or lower. Therefore when concrete is placed while these temperatures prevail, the accelerator in the mix is required in lieu of whatever method of curing is being used. When temperatures reach freezing, the contractor is required to heat the mixing water or aggregates, or both, and to cover the surface of the concrete with straw. Concrete pavement has been very satisfactorily constructed under these specifications at temperatures many degrees below freezing.

CONCRETE BASES

The Bates Road Tests definitely proved that the same consideration to structural design should be given concrete base as is given concrete pavement slabs. Wearing surfaces do tend to reduce the effect of temperature and

moisture changes, but not sufficiently to permit overlooking any of the design principles applying to concrete pavements.

The need for properly designed concrete to insure maximum durability is just as important for concrete bases as for concrete pavements. In the construction of the concrete bases on the world-famed Mount Vernon Highway, the Bureau of Public Roads used a concrete having a unit cement content of 1.5 barrels per cubic yard, which is the same as used by many highway departments for concrete pavements.

As a result of numerous researches on durability of concrete, there has been a trend toward increased unit cement contents, particularly for pavement base mixes. One of the most destructive agencies affecting the durability of concrete is freezing and thawing action, which is far more important in temperate climates than in extremely cold climates, since not more than three or four freezing and thawing cycles may take place each year in the extreme northern localities. In contrast, however, in the vicinity of Washington, D. C., concrete is subjected to twenty or more complete cycles of freezing and thawing. In other words our bases and pavements are subjected to the same deteriorating agencies, but following precedent we have used a leaner concrete mix for bases than for pavements. This is the common practice. The above is presented to show that our pavement and base concrete should be of comparable quality; the only variation in design being the utilization of a thinner slab for bases in view of the fact that internal stresses set up by temperature changes may be somewhat minimized by the protection of overlying brick or bituminous surfaces. The use of mixes with higher unit cement contents does require consideration of the volume changes of concrete. Probably the main reason for the lean concrete mix generally used in the past has been the inability of the old-type engineer properly to design and install satisfactory expansion joints.

The practicability of installing expansion joints in concrete bases has been demonstrated for some time. The Highway Department of the District of Columbia has been installing expansion joints and planes of weakness in all base construction for the past three years. The same specifications for transfer of loads are required for these expansion joints as for all joints in concrete pavements.

On one project where the subgrade conditions were unsatisfactory and the pavement subjected to a large volume of heavy-weight vehicles, expansion joints were spaced at 40-foot intervals with planes of weakness, including provision for transfer of load, at mid-points. This pavement has been in service for five years and though the freedom of movement of the concrete has caused cracks to follow through the sheet asphalt surface at some of the expansion joints, the pavements has proved structurally strong and has required no maintenance whatever for either base or surface.

Our general practice is to install planes of weakness each 15 feet with expansion joints at points of tangency, but not more than 300 feet apart. The planes of weakness are made in the plastic concrete by forming a vertical groove or cleft for a depth one-half the thickness of the slab, either by installing a material such as paper, which is left in place, or by a suitable installing bar or device used to form a narrow groove or cleft which remains open. A cleft of this depth insures that the slab will crack at this weakened plane when sufficient stress develops. As a result of such spacing of weakened planes, the

cracks separate but little, thus providing for load transfer due to the interlocking faces.

A survey of the pavements so constructed in the District of Columbia has shown that where the planes of weakness have been properly installed, the movement of individual sections is so minute that cracking of the asphalt surface is eliminated, except for occasional regular cracks over expansion joints. These expansion joints must be non-extruding and should be placed flush with the surface of the base concrete in such a manner as to furnish continuous support to the surface. The surface cracks which may form over the expansion joints are straight and seldom open sufficiently to require maintenance.

The development of non-extruding expansion joint installations, thereby making this use practicable in concrete bases, has made it possible to increase the unit cement content of concrete, as generally specified for pavement bases, and so provide a pavement of greater strength and durability. This Department has used both the air-cushion type and the resilient type of expansion joint in concrete base construction with success.

In the District of Columbia all concrete bases of 20 feet or more in width are constructed in two sections with a traffic marker dividing the pavement width. The two slabs are joined by a longitudinal formed keyway, in order to prevent displacement of the surface. The curb is constructed separately and is held to the slab by means of $\frac{1}{2}$ inch tie bars spaced at 2 feet 6 inch centers.

All of the principles brought out in the design and construction of concrete pavements, including thickened edges, should be applied to the design and construction of concrete pavement bases.

STABILIZING EARTH STREETS AND ROADS

The general principles involved in the design of stabilized soil mixes are essentially those practiced in designing bituminous or concrete mixtures, in that maximum density, utilizing existing sources of supply, is the prime requisite in either case. Undoubtedly the only factor of major deviation is the selection of the cohesive binder or cement; for concrete construction portland cement is utilized, for bituminous construction asphalt cement, while in the case of stabilized mixes varieties of cohesive clays are the binding mediums principally employed.

The yearly expense incurred in the repair of spring break-ups of common soil roads is enormous, and illustrates the need for greater initial care to secure an all-weather road; year-around service is truly the purpose of a stabilized road. The majority of our unimproved earth roads lack stability. For example, many contain too great a percentage of clay, and rut to such an extent that they are impassable in wet weather; others may be deficient in clay, with the consequence that ravelling and loss of road metal results; and still others may be of such a nature as to be materially destroyed by frost-heave action. These are but a few examples of unbalanced design.

Considering, then, that an ideal road is one which will not become soft and rut in wet weather, nor dusty and ravel in dry weather, nor heave as a result of frost action in winter, we have an established objective toward which to work. Tests promulgated by the Bureau of Public Roads, together with supplemental research work and years of practical field experience in all sections

of the country, have resulted in the establishment of recognized standards for this type of construction.

In accordance with the report of the Soils Committee of the Highway Research Board, soil constituents should be combined to provide the following:

1. Seating and embedment stability together with the density required to resist traffic pressures and impacts.
2. An internal bond, developed from interlocking grains and capillary moisture forces, sufficient to cause the coarse sizes of sand and the coarse aggregate to have high stability during wet weather when the cohesion furnished by the clay may become seriously reduced.
3. Sufficient cohesion in the binder to cement the sand and silt in dry or low moisture conditions and thus maintain the integrity of the surface during dry weather.
4. A surface which maintains constant volume; that is, there should not be so much clay that its expansion caused by water will dislocate the seating and embedment bond of the granular particles.
5. Active capillary movement of moisture and rapid evaporation to prevent accumulation of moisture from the subgrade beneath and to dispose of the rain water which may collect on the surface.

From the above it may be readily noted that when clay is used as a binder the stability of a soil road is vitally dependent upon the continued presence of moisture in an optimum amount. Due to its moisture retentive as well as hygroscopic properties, many engineers use calcium chloride for this purpose.

Gradation of Materials: The grading of the soil materials should be such as to furnish sufficient coarse aggregate to assure resistance to abrasive action of traffic and to provide coarse and fine sand in proper proportions to interlock and prevent sliding during wet weather conditions. The aggregate should consist of sound, tough, and durable particles of crushed stone, slag, or gravel. Material which will disintegrate when subjected to alternate wetting and drying or freezing and thawing should not be used. The following limits, by weight, have in general been recommended:

<i>Passing</i>	<i>Per cent</i>
1 inch sieve	100
$\frac{3}{4}$ inch sieve	80 — 100
$\frac{3}{8}$ inch sieve	50 — 90
No. 4 sieve	40 — 75
No. 10 sieve	30 — 55
No. 40 sieve	20 — 35
No. 200 sieve	10 — 20

Material larger than one inch can be used, but the proportion should not exceed 10 per cent; and the maximum size should not exceed one-third the thickness of the stabilized layer. The fraction passing the No. 200 sieve should be less than two-thirds of the fraction passing the No. 40 sieve. For base courses this fraction should not exceed 25 per cent and should be less than one-half of the fraction passing the No. 40 sieve.

Generally the plasticity index¹ of the material passing the No. 40 sieve should be between 4 and 12, and the liquid limit² should not exceed 35.

Construction Methods: Rapid progress is being made in the development of new equipment and simplified methods for construction of stabilized roads. Just recently a joint committee of the American Road Builders' Association and the Highway Research Board was organized to develop standard equipment for use in the construction of stabilized roads. Local conditions do affect materially the methods of construction to be used to obtain the best and most economical results; in the following paragraphs, however, are listed several significant details to be considered.

When the material in the subgrade is of firm soil, it may be bladed or cut to the final grade and cross section; any of this soil to be used in making the wearing course should be bladed to the shoulders of the road and left in windrows. If the subgrade consists of loose sandy material, sufficient binder should be added to form a stable mixture. If the subgrade is soft and unstable, it should be improved by the addition of granular material.

Any deficiency of the material in the existing surface to meet the requirements for a satisfactory mixture should be corrected by the addition of coarse aggregates, sand, or soil binder as needed.

The soil mixture must be thoroughly mixed by alternate spreading and windrowing, or by other effective methods, to the desired depth of wearing course. In order to maintain moisture in the optimum amount, engineers have incorporated calcium chloride in the road mix at the rate of $\frac{1}{2}$ lb. per square yard per inch thickness of wearing course, supplemented by a light application of about $\frac{1}{2}$ lb. per square yard of surface at the time of completion of the roadway. The incorporation of calcium chloride in the soil mixture before compaction has been found to be more practicable than the surface application only. The calcium chloride in that way is retained for a longer period of time and greater density is obtained from the same degree of compaction.

It is most important in the final shaping of the road to construct a proper cross section. The surface must have sufficient crown to provide rapid drainage, but should be as flat as practicable for ease and safety in driving. Study of this problem has indicated that a crown of not less than $\frac{3}{8}$ inch per foot must be maintained to insure satisfactory service, and prevent "pot-holing."

Seasoning: The seasoning period may properly be termed the period during which compaction is attained. It is during this period that the continued presence of free moisture to aid in consolidation of the soil is so essential. This period is certainly the most important affecting the life of the road. Unless there is sufficient lubricating moisture to secure maximum compaction, the resulting road will not have the desired wet weather stability. Consider that

¹ *Plasticity index.*—The plasticity index is the difference between the liquid and the plastic limits. It is an expression of the range of moisture contents through which plastic soils remain plastic and consequently cohesive. The plasticity index, in other words, indicates the amount of water, in excess of that represented by the plastic limit, which must be added in order to reduce the cohesion of the soil to practically zero, its state at the liquid limit. It may, therefore, be considered as a qualitative measure of the cohesive property of the soil.

Plastic limit.—The plastic limit is defined as the minimum moisture content at which the soil can exist in the plastic state.

² *Liquid limit.*—The liquid limit is defined as the moisture content of the soil at which small shocks will just cause it to flow. It is the maximum moisture content of plastic soils when in the plastic state, and is indicative of the maximum capillary capacity of all soils, plastic or nonplastic. At the liquid limit the cohesion is practically equal to zero.

sufficient loss of moisture takes place before maximum compaction is attained so that the degree of consolidation secured corresponds to a density of 97 lb. per cubic foot (see Figure 1). Under this degree of consolidation, this particular soil is capable of absorbing moisture up to 27 per cent during rainy seasons, with the consequence that in wet weather instability prevails.

Calcium chloride is particularly beneficial during this seasoning period in that its power to lower the vapor pressure of the resulting solution controls the rate of moisture loss, and permits a greater density to be attained with the same degree of compaction.

Soils compacted at the optimum moisture content may attain greater stability in dry weather, due to evaporation; however, during wet weather they could not have less stability than that indicated by the stability at the optimum moisture content for the pores at such a time would be completely filled and further entrance of moisture would be prevented.

Optimum moisture content slightly below the plastic limit with the initial mixing water slightly above seem to provide the most favorable balance between lubricating and adhesive properties. Soils with optimum moisture content approximately equal to or below the plastic limit seem the most desirable, with the desirability decreasing the more the optimum moisture content exceeds the plastic limit.

Base and Surface Courses: Several years of experience have proved that the composition of base and surface courses should not be considered identical. In differentiating between the two, however, we are more concerned with the properties of the binder than with the aggregate making up the road. Although a stabilized road may prove most satisfactory as such, it is possible for this same road to fail when covered with a bituminous mat or a higher type pavement. This failure undoubtedly is due to the retardation of surface evaporation, with a resultant water-logging of the soil. As discussed in the following section, the activity of the soil binder is a prime factor governing the performance of a stabilized road.

As a result of this tendency for soils to take up moisture when surface evaporation is prevented, it is advisable that lower plasticity indices be chosen for roads which ultimately are to be covered than for roads for which no higher development is considered. In general the plasticity indices for bases should be lower than those for surfaces, possibly 4 to 8.

Maintenance: Blading of a calcium chloride stabilized road should be done immediately after rains, as the surface at other times will not be workable. Small holes should be patched with a mixture composed of 100 to 150 pounds of calcium chloride per cubic yard of graded soil.

In order to maintain the moisture of the road surface, which is required for stability, it is necessary to apply calcium chloride two or three times each year according to the weather conditions. About two pounds per square yard is applied each year; one pound early in the summer and subsequent applications of one-half pound per square yard according to the condition of the soil. Care should be used to be sure the surface does not dry out too much before applying the calcium chloride.

Plant Mixing of Stabilized Aggregates: One development following the progress in the practical application of the principles of stabilization, which has become of particular interest, is that of plant mixing of material. Since the success to be attained in constructing stabilized roads depends to a large

extent on the uniformity of the surfacing mixture, placing a pre-mixed material rather than mixing on the road affords real advantage to municipalities and smaller political units. Such a plant should consist essentially of an apparatus for proper drying and pulverizing of the clay binder and a means for measuring and mixing the proper quantities of soil binder, graded aggregate, and water.

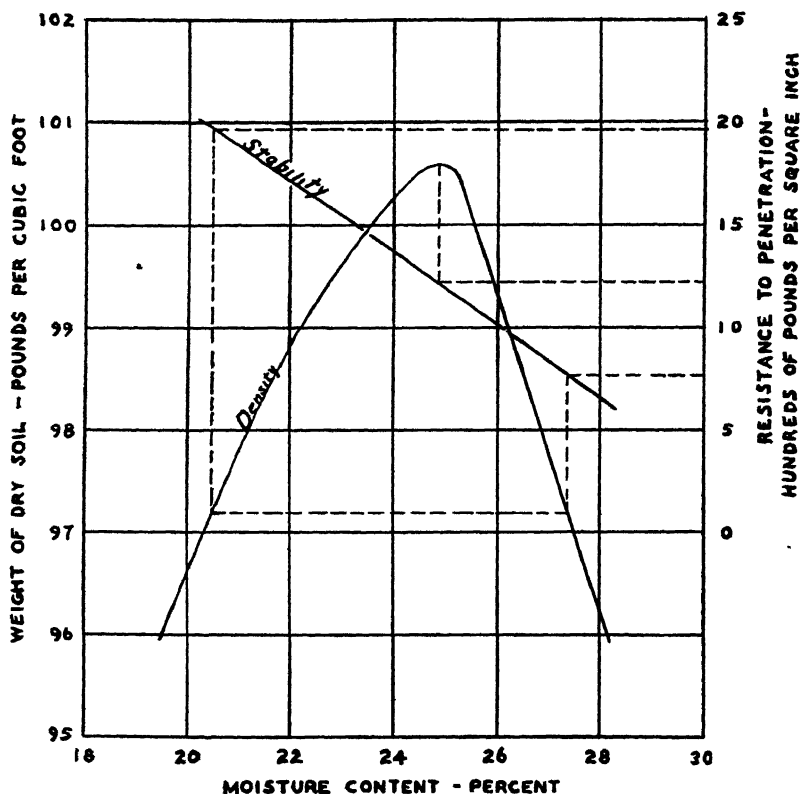


FIGURE 1. RESULTS FURNISHED BY COMPACTION TESTS

In the city of Detroit a stabilized wearing course material, using clay, coarse and fine aggregate, water and calcium chloride, is obtained in a very satisfactory manner by the use of a stationary plant. The clay binder is stripped from nearby locations, pulverized and rendered suitable for use in the mix by the removal of undesirable foreign matter. The different grades of aggregate and the clay are deposited in individual hoppers situated directly over a large belt conveyor running to a pug mill mixer. By means of screw feeders at the bottom of these bins the amount of each material can easily be controlled to insure a satisfactory mixture. The particular advantage of this arrangement is that once the proper proportions are experimentally determined,

they can be maintained in constant proportion. Just before the clay and aggregate on the conveyor belt reach the mixer, calcium chloride is fed onto the belt from a small hopper. The mixing is carried on continuously in a pug mill and the stabilized mixture then lifted by means of bucket conveyors to a large storage bin from which it can be deposited into trucks at any time.

Stage Construction: By this process is meant the progressive improvement of a road, or system of roads, as conditions require. For example, in a locality where traffic is of an intermittent and light-weight nature, certainly the most economical investment would be a stabilized road. With the thought that this road might eventually be utilized as a main artery, it would be advisable to construct it as a base and not as a wearing surface. Then as traffic increased successive stages would follow, with possibly a bituminous mat and later a concrete surface. In either case, however, the initial stabilized road would be a permanent investment due to its utilization as a base and also as a result of its high serviceability while in use as a wearing course. To illustrate the efficiency of constructing bases of high bearing value, the following summarization is quoted from a discussion by C. A. Hogentogler of the United States Bureau of Public Roads in a report, *Interrelation of Load, Road and Subgrade*:

The excellent condition, after years of service, of the concrete pavements, 4½ and 5 inches thick, which rested upon California sands; the absence of cracking after 12 years of service in that portion of the Gansevoort-South Glens Falls (N.Y.) road, which rests upon sand and is 4¾ inches thick at the edges and 6¾ inches thick in the center; the good condition after 12 years of service of the DuPont Road, Delaware, which rests upon a gravel subgrade and is 5 inches thick at the edges and 7 inches thick in the center; and the excellent service rendered by pavements laid on concrete bases 4 inches thick, which rest on sand in the vicinity of Cleveland, Ohio, indicate that relatively thin concrete pavements, say for instance 7 inches thick at the edges and 5 inches thick in the center, may furnish adequate load capacity when laid on satisfactory subgrades.

Stabilized roadways offer exceptional advantages to localities where revenue is limited, but where at the same time the demand exists for dependable traffic arteries. This method of road improvement has been widely adopted by communities of all sizes, for example, Midland, Michigan; Ames, Iowa; and Detroit, Michigan; the latter city has hundreds of miles of outlying secondary roads to which this type of construction is being adapted.

The economic advantage of constructing stabilized roads, the value to be derived from properly treated soil for subgrade for high-type pavements, and the facts which have recently been developed as to stresses in rigid type pavements, lend new interest to the highway engineer in his effort to plan and construct the most economical and serviceable road program.

REPORT OF THE COMMITTEE ON SPECIFICATIONS FOR BRICK PAVEMENTS

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Chairman of and Reporting for the Committee on Specifications for
Brick Pavements*

AN ALL-DAY meeting of the Committee on Specifications for Brick Pavements of the American Society of Municipal Engineers was held in Washington on Saturday, September 12, with five out of seven members of the Committee present. Those present were G. F. Schlesinger, William C. Perkins, J. G. Barbour, A. Mason Harris, and Roy L. Phillips.

At the beginning of the meeting it was decided that it was not desirable to submit any specification changes to the Society at this time but the Committee authorized one editorial change in the present specifications. It was the intention of the Committee to prevent the use of brick lugs which would be continuous from the top to the bottom of the brick, and some possibility seemed to exist that such continuous lugs on the side of the brick would be permitted. In order to prevent any misunderstanding, the following sentence was added to the first paragraph under the heading "Lugs" in the specifications: "No lug shall be continuous from top to bottom of the brick but shall be of a type that allows free horizontal flow of the filler." This clarifying sentence will be found in the next printing of the specifications.

The Committee is at present engaged in writing standard specifications for resurfacing with brick and for taking up, cleaning, and relaying old brick surfaces where such surfaces have become rough after long service. Such relaying has found a great deal of favor under the Work Relief Program and a standard practice is being developed by your Committee to govern such work in the future. This information will be ready for publication as proposed specifications in the near future.

A discussion of the brick types now manufactured developed the fact that non-meshing center lugs on the ends of the brick are in some cases charged with the responsibility for a horizontal rocking motion of the brick about these lugs as a center and a tendency of such brick to creep under the roller. In some cases this has resulted in throwing rows out of alignment. Studies are being made to develop staggered corner lugs which will give a lug-to-brick contact rather than lug-to-lug at the ends of the brick. It is also suggested that it is desirable for the engineer to ask the contractor to name, on the bidding blank, the brand or brands on which he is bidding.

Bituminous fillers are being studied by many agencies at this time. The exuding of bituminous fillers in some cases seems to be their one weakness. This problem is not at all general on city pavements but is troublesome in a sufficient number of cases to justify every effort to solve it. The Hocking

*SPECIFICATIONS COMMITTEE ON BRICK PAVEMENTS, 1936

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County Test Road (Ohio Route No. 31) is an outstanding example of the efforts to get reliable information on fillers. Blended asphalts, mineral filled asphalts, plastic sulphur, and some tars are giving interesting results here as elsewhere but sufficient reliable information is not yet available to justify definite recommendations for specification revision.

Bituminous material for mastic beds and the amount of bitumen to be used provide controversial subjects. It seems to be the opinion that tar mixtures work easier than asphalts but the asphaltic mixtures maintain their original condition better. Some engineers feel that as much bitumen should be used as can be handled in a workable mix while others are contrary minded. It is a fact that where tars are used in too small a quantity, a later investigation of the bed after use shows little more than dirty sand remaining. Your Committee recommends that in every case the base be primed with a cut back bitumen and every effort be made to provide a mixture of bed materials which will retain its stability over a period of years. Best results have been obtained where an asphalt plant is used to prepare the mastic bed.

Although the work of this Committee does not cover base construction, the Committee does wish to emphasize the importance of smoothly finished bases built to correct templet shape so that the uniform $\frac{3}{4}$ -inch cushion may be made possible. Too great a variation in cushion resulting from poorly finished bases will in time give an unsatisfactory pavement surface. So-called lean mixed bases and weakened planes at intervals of not over 40 feet to act as controlled contraction joints are recommended.

Contrasting colored brick are being widely used as center line markers. It is standard practice in some cities to lay these markers in alternate courses of brick and when they are used, laying should be started at the center of the street and proceed from there to both curbs as it is only in this way that markers may be held in good alignment.

The practice of attempting to lay brick radially around curves by spreading joints at the outside of the curve is being discouraged. Better practice is to proceed with the laying in the regular manner and insert a wedge or "Dutchman" whenever the alignment of the brick departs too far from the radial line of the street. Some cities make it standard practice to use the wedge when the alignment has dropped back $2\frac{1}{2}$ brick. Vertical fiber lug brick are being laid parallel with the center line of the road on a test road in Ohio. This plan will entirely eliminate battering in at the curbs, will reduce vibration by reducing the number of transverse joints and will possibly increase the power of the brick surface to span base cracks by laying the brick at right angles to transverse cracks. Your Committee will watch this road with a great deal of interest.

Brick rolling and the proper weight of roller has always been a controversial subject. Movement of the brick under the roller at times disturbs the alignment of the rows and the rise of bed material in the joints seems to bother some engineers. Richmond, Virginia, has developed a unique plan of covering the surface of the brick with $\frac{1}{16}$ -inch boards and using a roller weighing from five to ten tons on top of the boards. This results in minimizing the movement of the brick. The following specification is used:

After the bricks have been laid, the lines straightened, the surface swept free of chips and the work approved by the inspector, the brick shall be rolled with a power-driven tandem roller weighing not less than five nor more than ten tons. Rolling shall be done longitudinally on boards not less

than ten (10) inches wide and twelve (12) feet long, dressed to a uniform thickness of $1\frac{3}{16}$ inches laid longitudinally and in close contact. Rolling shall start at one curb of the street. The roller shall not progress more than ten (10) inches transversely at each longitudinal roll. Sufficient boards will be required for longitudinal rolling of 24 feet. Boards which become split or broken shall be replaced.

Cement grout filler is being used in some places, and when used should be cured with wet straw. This is standard practice at this time.

RECENT PROGRESS IN CONCRETE AND BRICK PAVEMENTS

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THIS report of the committee reviews the developments in street paving as related to concrete and brick pavements.

CONCRETE PAVEMENTS

Recent progress relative to concrete paving comprises three phases of the subject, namely, joints, service life, and vibration. State highway departments are actively investigating the design of joints for concrete pavements. The investigations are along two lines: first, load transfer properties; and second, fillers or seals.

The function of joints in concrete pavement is to provide relief from stresses caused by changes in volume of the concrete. This relief is easily provided by dividing the pavement area into sections of such size that the resulting stresses are kept within safe limits. Unfortunately, the division introduces new problems. The ends of each section are potential points of weakness. The pavement must either be made thick enough at each edge so that it has sufficient strength to carry the load alone or provision must be made for transferring a portion of the load across the joint to adjacent slabs. This is accomplished by means of dowels or some form of interlocking joint which will cause the adjacent slabs to act together in vertical movements but give them all necessary freedom for horizontal movements. To determine the relative efficiency of dowels and other devices, various agencies have conducted tests which supplement computations based on principles of structural design.

At the December 1935 meeting of the Highway Research Board, Division of Engineering and Industrial Research, National Research Council, J. W. Kushing and W. O. Fremont of the Michigan State Highway Department reported on a method of testing pavement parts and gave results on several types. The critical point, beyond which the relation of deflection to applied load is no longer a straight line, ranged from 156 to 993 pounds per linear inch of joint. The deflection at the critical point ranged from .005 inch to .050 inch.

The Kansas State Highway Department has made some tests on capacity of different types of load transference devices. An interesting result was the demonstration of large capacity of dowels of standard steel pipe as compared with the capacity of steel bar dowels of the ordinary type. The results have not been published.

*COMMITTEE ON STREET PAVING, CONSTRUCTION, DESIGN AND MAINTENANCE, 1936

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The Illinois tests were made under the direction of V. L. Glover, Engineer of Materials of the Illinois Division of Highways. They consisted of five series of tests, reports of which were issued separately. The load transfer capacity and the deflection across $\frac{3}{4}$ -inch joints equipped with ordinary $\frac{3}{4}$ x 24-inch bar dowels were compared with similar quantities for $\frac{3}{4}$ -inch joints equipped with shorter $\frac{3}{4}$ -inch dowels combined with anchors of various types. In general the short dowels combined with anchors performed better than the ordinary long dowels, safely transferring greater loads with less deflection.

It was stated that, for the concrete used in the Illinois tests, the ability of the concrete to resist bearing stresses was considerably greater than the ability of the steel dowels to resist bending. The dowels were well past their elastic limit and had taken a permanent deformation before failure of the concrete occurred.

The research projects previously mentioned were concerned with only the first phase of the subject, that pertaining to load transfer properties. The Indiana State Highway Department carries the research into the field of fillers and seals. Federal Aid projects 40, A2 and A3, constructed in 1935, involved the widening of an existing concrete road by constructing 10-foot lanes on each side of the old pavement. On these projects, 23 different combinations of load transfer devices and joint fillers and seals were installed for observation and test. Also a record was kept of the cost of the different installations. Both expansion and contraction joints were investigated. The study includes four types of load transference, combined with air cushions, premolded bituminous, cork, rubber, and poured bituminous filler.

No report on the Indiana tests has been published and insufficient time has elapsed since construction to permit the drawing of definite conclusions.

LIFE OF PAVEMENTS

A cooperative study of the service lives of pavements is being conducted under the joint supervision of the Engineering Experiment Station of Iowa State College and the United States Bureau of Public Roads. A very brief preliminary report was presented at the December 1935 meeting of the Highway Research Board and printed in the 15th Volume of the Proceedings of the Board. Unfortunately, this report contained so little of the data from the individual studies that it is apt to confuse rather than inform.

Studies have been made on pavements in Des Moines, Iowa, Buffalo, N. Y., New York City, on the county highways of Wayne County, Michigan, and on the state highways of Massachusetts, Rhode Island, and New Hampshire. Similar studies have been started in Connecticut, Vermont, and Michigan, and are proposed on about 30 additional state highway systems on which "fact-finding" surveys are being made as cooperative projects of the U. S. Bureau of Public Roads and the several state highway organizations.

To enable engineers to understand and evaluate the results of this study, it is well to explain briefly the method used. Life of a given pavement type in a state, county, or city is estimated by observing its annual rate of retirement for as long a period as the data are available. The accumulative percentage of retirements is plotted against the age of the pavement. The curve so obtained is compared with a set of 18 type curves. The latter curves were developed in studies of retirement of properties of various kinds, mostly in the public utility

field. From this set of curves there is selected the one which seems to best fit or agree with so much of the curve as can be plotted for the type of pavement being investigated. The typical curve is then used to extend that curve so that the complete history of the pavement may be predicted.

Obviously, the comparison of shape of curves cannot be made until there have been sufficient retirements over a period of years so that enough curve may be plotted to indicate its shape. For some types of pavement, such as concrete, which have been built in large volume only within the last 15 years, the amount of retirements has been so limited that it is not always easy to plot enough curve clearly to indicate the trend.

The method does not take into account the reason for retirements. A pavement retired because of another improvement, such as a grade separation, is treated just the same as one retired because of failure due to traffic or climatic conditions. Neither is any weight given to the admitted fact that pavements in recent years have been subjected to volume and weight of traffic much heavier than pavements were required to carry in earlier years.

Although we cannot be completely assured that pavement retirements are going to follow the same law that was followed by the utility properties used to determine the shape of the 18 type curves, the studies will undoubtedly yield better information than is now available on which to base estimates of pavement lives. Also the studies, if continued, will eventually build up a mass of data from which satisfactory type curves can be plotted.

VIBRATION IN PLACING CONCRETE PAVEMENTS

Except for such work as has been done in the pavement of streetcar track areas, research into vibrated concrete for pavements seems to have been confined to the State Highway Departments and the U. S. Bureau of Public Roads. But, as vibration is equally applicable to the paving of city streets, some comment on current research is not out of place. While it is of current interest, some work has been done with it for several years.

Among the research projects investigating vibration as a method of placing concrete pavement are the following:

1. The U. S. Bureau of Public Roads described in the October 1933 issue of *Public Roads* a series of tests which the Bureau's engineers conducted at its Arlington, Va., laboratory. It was found that leaner, dryer, and harsher mixes than would be practical with ordinary equipment and methods could be used in connection with vibratory methods of placing and finishing. This should result in pavements which are better and at the same time cheaper. To obtain full advantage of the method it was necessary to increase the proportion of coarse aggregate and to hold it within rather narrow limits, a condition not difficult to meet with present day proportioning equipment.

2. Illinois has used vibration experimentally on one project consisting of 114 individual sections with aggregate mixtures and methods varying in the different sections. Vibration was applied by electrically operated vibrators attached to both screens of a standard type finishing machine. It was indicated that the water-cement ratio could be reduced about $\frac{1}{2}$ gallon per bag of cement below that which could be attained with the standard mix placed without vibration. This would permit either a considerable increase in strength at little or no increase in cost or a reduced cost without sacrifice of strength.

Some of the sections showed a slight surface scaling, indicating that it will

be necessary to guard against the accumulation of too much mortar or water on the surface when vibration is used.

3. Experiments in Ohio showed that where the regular mix was used with vibratory placement there was no increase in strength. But when the percentage of sand was reduced from 40 per cent, the regular figure, to 36 per cent, and a corresponding adjustment made in the amount of mixing water, the strength was 32 per cent greater than for the concrete placed by the regular method with the same cement content. Contrary to experience in other states, Ohio reported no difficulty in handling and spreading the harsh concrete.

4. Missouri found vibratory placement to result in a saving in cost of materials ranging up to about 10 cents per square yard. As in some other research projects, comment was made on the greater difficulty of spreading the harsh concrete required for best results. It was thought that a mechanical spreader would have permitted the use of still harsher and leaner mixes, with further economy.

5. This idea was checked on a project conducted by the Michigan Highway Department. As in the other states it was found that money could be saved by the use of dryer mixes containing a greater proportion of coarse aggregate, combined with vibratory placement.

6. New Jersey has done more with vibratory placement of concrete pavement than any other state. Reports from that state agree that, when properly controlled, it offers opportunity for improving and cheapening concrete pavement.

In most of these experiments the vibration has been applied to the surface of the concrete only, by means of vibrators attached to the finishing machine screens. It has been claimed that there would be some advantage in a more complete vibration of the mass. It is known that there are in the process of development machines which combine the functions of a spreader and finisher, applying vibration to the concrete as it is deposited on the subgrade. Preliminary tests of at least two of these machines have been promising but neither is on the market yet. There are available vibratory finishing machines of the general type used on the research projects mentioned herein.

BRICK PAVEMENTS

Since 1921 the Division of Simplified Practice of the U. S. Bureau of Standards, through a committee composed of representatives of engineering and technical societies, has annually recommended a standard list of sizes and varieties of paving brick.

Following is the current recognized list:

Type	Depth	Size Width	Length	Pct. '34 Shipments
Vertical Fiber Lugless.	2½	4	8½	9.7
Vertical Fiber Lugless.	3	4	8½	5.9
Repressed Lug	4	3½	8½	9.6
Vertical Fiber Lug	2½	4	8½	19.1
Vertical Fiber Lug	3	4	8½	37.5
Vertical Fiber Lug	3½	4	8½	6.6
Total of 6 Varieties Recognized				88.4

It will be noted that all varieties of the wire-cut-lug brick have now been

eliminated, having been replaced with the vertical fiber lug brick type of three depths— $2\frac{1}{2}$, 3 and $3\frac{1}{2}$ inches.

DE-AIRED PAVING BRICK

The commercial application of the evacuating or air-extracting process of producing paving brick is an innovation of the past few years. Sufficient experience has been had with de-aired paving brick to justify the conclusion that with proper production methods, a new paving unit of greater strength and density, which retains all the old advantages of regularity of shape, is now available to the highway engineer.

Results from the investigation undertaken by the U. S. Bureau of Public Roads in cooperation with the National Paving Brick Association are not yet available. However, it is planned to develop standardization of physical requirements and tests.

BED COURSE OR CUSHION

The trend is toward the increased use of the bituminous mastic cushion although untreated sand, stone screenings, granulated slag, or sand-cement still have their proponents. The specifications for mastic bed of the Vitrified Brick Pavement Specifications of the American Public Works Association are typical of those in general use. During the past year it was considered desirable, particularly for brick resurfacing over worn concrete, to develop a bituminous mastic cushion with greater stability and crack-bridging qualities. This required an increase in bitumen content in a mixture that could be prepared by the contractor without elaborate equipment or extensive experience. A specification for this type of mastic was prepared for the National Paving Brick Association by the Chicago Testing Laboratory which has an ultimate bitumen content of about 10 per cent and has the characteristics of a fine aggregate bituminous concrete. Powdered asphalt and suitable flux which amalgamate quickly are used. Excellent results were obtained in the laboratory and it is expected soon to have further experience with this cushion material in actual construction. There is of course some increase in cost.

FILLER

The surface removal method of bituminous filler application introduced several years ago has now become practically universal practice. The requirements for this method as at present practiced are covered in the A.P.W.A. Brick Pavement Specifications. The Research Bureau of the National Paving Brick Association has recently developed a device for applying the separating agent which is expected to be an improvement on present methods. It consists of a cast-iron roller covered with a sponge rubber shell with a storage tank and compressed air feed.

Investigations by Messrs. Stinson and Roberts, reported to the Highway Research Board, indicated that the coefficient of friction, both rolling and sliding on "a vertical fiber brick road, free of asphalt filler" was practically the highest of any of the types that were included on their tests. Observations made by them on the same pavement during the second and third years after completion indicated a measurable reduction in friction. According to their report, this was due to the asphalt progressively exuding from the joints and covering a considerable percentage of the surface. The National Paving Brick Associa-

tion, recognizing the important bearing of filler exudation on the anti-skid properties of the brick pavement, has made an extensive investigation in its Research Laboratory with a view to developing a filler that will be less exuding in character than the asphaltic material now in general use. Laboratory tests simulated service conditions with brick pavements having joints filled with various materials, constructed in panels and subjected to electrical heat on a definite schedule. The most promising of the fillers developed in the laboratory will be tested in actual service in a brick pavement recently constructed under the supervision of the U. S. Bureau of Public Roads and the Ohio Highway Department on Ohio Route 31, the Columbus-Athens Road in Hocking and Fairfield Counties. There are fifteen sections of brick pavement, each about 500 feet in length, in which different varieties of fillers have been used. Tests will be made seeking to determine the exuding of filler; effect of heavy loads; temperature gradient; tractive resistance as related to the amount of exuded filler; effects of separating agents on adhesion; shrinkage; and moisture proofing qualities.

BASE COURSES AND MONOLITHIC

The requirements for foundations or base courses will vary according to local conditions of climate, sub-soil, and traffic loads. In the southern section of the country, vitrified brick surface courses are successfully used on such foundations as natural sand, chert, gravel, crushed stone, slag, and Florida lime rock. Brick pavements have, of course, given excellent service on macadam, black base and concrete. Concrete is the material commonly used as a foundation course for city streets and heavy traffic pavements. If a poured or pre-molded expansion joint is used in a concrete base, it should extend to the top of the brick surface course. Experience indicates, however, that contraction joints only, at intervals of 25 to 40 feet depending on conditions, will meet all requirements. Planes of weakness in the brick surfaces over the base contraction joints as described in the A.P.W.A. specifications are recommended.

In connection with a discussion of joints in concrete bases it seems appropriate to mention that the monolithic type of brick pavement shows some signs of revival. In this design the brick without cushion are laid directly on the green concrete base with cement grout filler. On an experimental brick road on Ohio Route 43 in Carroll County, constructed in 1933, a section of monolithic was included. The construction included a longitudinal center and one-inch transverse expansion joints at intervals varying from 50 to 100 feet. A smooth surface was secured and the section is now in perfect condition. Further projects of this design are contemplated.

As in 1935 and previous years, work relief programs included a considerable quantity of salvaging and relaying old paving brick.

Anson Marston, Senior Dean of Engineering at Iowa State College and one of the leading engineering and highway authorities, has published a most interesting report on "A Mortality Curve Study of the Actual Service Lives of Brick-on-Concrete Pavements, Des Moines, Iowa, 1909-1928." In his investigations, Dean Marston makes a unique but logical use of mortality curves, used in actuarial work, to estimate the service lives of brick-on-concrete pavements based on a construction period of twenty years. The factual data show that, in Des Moines, 91 per cent of brick pavements 16½ years old are still in service and that 60 per cent of those 33½ years in age have survived. The statement

is made that, based on the retirements of brick-on-concrete pavements in Des Moines from 1919 to 1928 inclusive (10-year period), the average life would be 36 years. Based on those retired in a 20-year period from 1909 to 1928 inclusive, the average life indicated is 28 years.

DISCUSSION

MR. HENRY L. HOWE (Rochester, N. Y.): In the city of Rochester we had a number of federal aid, one-hundred-per-cent-grant, paving projects within the city limits, carried out under contracts awarded by the State Highway Department in cooperation with the City Engineer's Office which draws all of the plans and makes the surveys. These projects have been the paving of the main arteries in the city, usually asphalt pavement forty or fifty feet between curbs. At the start of that work the State District Engineer became much interested in base joints and we began with one street with a street car track, experimenting with base joints to design our cracks where we want them and when we want them. In that particular street we used rubber joints and cork joints and steel slip joints properly doweled, and tie bars where they should be and not where we felt they should not be. On the next project of that type we used other spacing of similar joints. Then on another project they used impregnated wood joints with still different spaces, and on the last project I think they continued to use the wood joints. As a result we hope to have in Rochester a very good demonstration of asphalt base joints for anyone interested in that newer method of designing asphalt paving bases.

MR. FREDERICK T. PAUL (Minneapolis, Minn.): I think there is one field in which this organization could do some very good work and that is in the type of specifications used by our National Bureau of Roads. I spent four months last year in attempting to convince that Bureau that we need a different type of asphalt specifications for the northern states than they need through the south. They have one specification for the whole United States and I think the northern engineers who have had some experience, and especially the engineers in Minnesota, Wisconsin, and Michigan, will agree that the same type of asphalt will not do in those states located in the northern part of the United States. I think this organization can do some very good work if we can convince the Bureau of Public Roads that they ought to have flexible specifications for use in different parts of the country.

MR. E. L. KNEBES (Milwaukee, Wis.): I agree with Mr. Paul. We had the same experience, but we are not getting very far in trying to get the Federal Bureau of Roads to change those specifications.

I would like to ask Mr. Howe if they had any experience with the top cracking over the joints in the base. I don't suppose they have been in long enough to get any real test as yet.

MR. HOWE: We designed space joints in order to get the crack through the top where we wanted it, in a straight line from curb to curb, or from curb to the street railway tracks. On the Monroe Avenue project where we used the combination of expansion joints, using cork or rubber expansion joints, about every 150 feet or near intersections, we put dummy joints between such expansion joints. The dummy joints consisted simply of pressing a metal strip into the concrete before it set to the extent of about one or two inches deep in the base and clipping every other wire going through that joint, thus making a

weak spot at that point. Both the dummy joints, which I think were placed every twenty or thirty feet, as well as the expansion joints, cracked through to the top as they were designed to do.

In other words we feel it is better, particularly where you have the richer pavement bases, to have more cracks designed where you want them than to have a few large irregular cracks running across your street in every direction. The ultimate answer, of course, is to develop a method of laying your asphalt pavement so as to carry that base joint definitely through the surface to give an absolutely straight line and not an irregular or torn line. I think that is the next step in the problem of base joint designs.

THE MANAGEMENT OF A SEWAGE TREATMENT PLANT

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THE MODERN sewage treatment works of today receives far more attention than did its neglected antecedent of even a decade ago. This is especially true of the relatively small installations. Notwithstanding this noteworthy progress, however, there is still room to improve appreciation of the function a municipal sewage treatment plant should perform. This lack of appreciation is oftentimes reflected, both in general and in detail, by lack of the provision of sufficient operating funds so that maximum service and returns may be received from the amounts available for distribution. Except in those instances where specific income is allocated to definite use, as where sewer service or rental charges are made, there is still the tendency and temptation to forget the sewage plant, since it is usually located outside the gates of the city, and is therefore less likely to come under the notice of the critical citizen and taxpayer.

In this connection it is pertinent to question whether or not the sewage plant should rank as a major municipal responsibility, along with water supply, streets, lighting, safety, and others duly recognized as important. That such is a growing trend is manifested by the increasing number of sewage plants designed, built, and operated as a credit to the community. The development of civic pride, the growing importance of sanitation as contributing to improved public health conditions, together with the fact that riparian owners are no longer content to tolerate the noisome odors and other undesirable effects of sewage decomposition, are factors in developing a consciousness that proper sewage disposal is indeed an important though still somewhat by-passed part of municipal business.

If, then, a sewage plant may be regarded as an integral part of municipal activities, how should its affairs be administered?

Four more or less correlated interests are directly concerned with sewage plant management, namely: the state; the municipal executive in whose department the plant is; the plant superintendent or supervisor; and the operators.

Sewage treatment works are installed usually to attain definite objectives, such as to protect a public water supply, bathing beach, or other recreational water against undue contamination; to safeguard waters against the killing of fish and the spoiling of drinking water supplies of cattle; and to prevent unsightliness, odors, and general nuisance attributable to uncontrolled sewage discharge.

The state is particularly concerned that the plant installed be adequate to meet its peculiar requirements and that it be operated in such manner as to accomplish its intended purpose. To this end the government official makes inspections, demands reports, and is either helpful or otherwise, depending upon whether he has an appreciative knowledge of the problems involved or

acts merely as a policeman. Conferences on sewage treatment sponsored by state health departments have had marked influence in elevating the plane of sewage plant operation and management, not only in respect to the problems of the plant itself, but notably also in arousing a sense of responsibility in municipal officials. It is gratifying to observe that supervision on the part of the state is now directed largely toward improved management by constructive suggestions rather than to destructive criticism. Police tactics always put the plant superintendent on the defensive in an effort to elude and evade lapses, whereas a sympathetic attitude invites confidence and promotes co-operation.

Recently the newly appointed chairman of the sewer committee of a small town council admitted that he had never seen the sewage plant although it had been in service for some twenty years. Ten years ago in this same town he would have served his two years and remained undisturbed and uninformed, although the farmer through whose pasture the effluent flows might have registered several complaints. Today, however, when the plant at the state's insistence is being operated under the direction of a part-time technical supervisor, he is taken to the site, and the function and purpose of each of the several treatment units explained. In consequence he is more appreciative of the necessity for certain expenditures, the request for which in all probability would otherwise have been entirely ignored or else indefinitely postponed. Similar instances of better understanding between the resident operator and the uptown office are becoming more common, with the result that the sewage plant is regarded as a member of the municipal family and not treated as a poor relation. The importance of this factor in securing effective sewage plant operation and management cannot be too greatly emphasized.

Perhaps the most important link in the chain of sewage plant administration is the superintendent. The larger the plant the more essential it is to have a competent resident supervisor. To him falls the duty of carrying out policies formulated by state and municipality, and upon him rests the direct burden of producing maximum plant efficiency at minimum expense. Even the small or one-man plant is expected to give an accounting of methods pursued and results accomplished. At the larger plants where an engineer or chemist-superintendent is employed full time, much more is rightly expected, and it is to this class that some attention may be directed in consideration of detail of management.

The duties of a plant superintendent naturally fall into several classes: general policy; operating personnel; laboratory control; maintenance and upkeep; cost accounting; and records. It is obvious that there should be close cooperation between the superintendent and the executive who secures the appropriation. Between them should be established budget requirements and policies and every effort made to reach the goals set. By policy is meant decision as to general plan of procedure regarding political influence, wages, hours of labor, plant upkeep of both grounds and treatment devices, disposal of sludge cake whether by gift or by sale, and other matters of like import.

At this point it might be well to raise the question relative to the policy of plant beautification. There is no doubt of the growing popularity of beautifying sewage plant surroundings with attractive shrubbery and velvety lawns. In this policy we most heartily concur. On the other hand, caution must be observed so that normal plant functions are not neglected. Both are essential to effective

operation, but beautiful lawns and flowering shrubs will not decrease the B.O.D. of a stream depleted by a poor effluent, although it might divert the nose from a somewhat ill-smelling settling tank. The question arises also whether it is not better for the interested citizen to find a park where he expects only a sewage plant, than to find a sewage plant where he expected to see only a park. It is difficult to hide the unsavory purposes of a sewage works even from the uninitiated, although it must be recognized that prejudices can be allayed if the surroundings are clean, attractive and generally respectable.

A sewage plant should have an operating personnel adequate in number and competent as to mental and physical ability. Politics or favoritism deserve no part. Capable men should be selected and assured tenure under good behavior and faithful service. Licensing of operators after due examination, both physical and mental, is to be most highly commended and urgently advocated. Overloading the payroll with loafers is fatal to discipline and often results in denying those who are willing to work a proper competence.

Every sewage plant is entitled to as much laboratory control as possible. The whole works may be regarded as a factory, producing an end product by stages through the agency of delicate machinery at each step. It is important to know just how each unit performs. To this end a laboratory well equipped as to apparatus and personnel should be utilized constantly. But here also a word of caution appears proper. It is obvious that a small plant operator cannot devote too much time to sampling and tests when other duties demand his attention. Also, on the larger plant the chemist-superintendent without an assistant is handicapped in supervising outside work if he is tied down to a laboratory bench or to a calculating machine. Routine laboratory analyses often lose their value because, in the effort to keep abreast of the work, there is no time to study results and govern the operating procedures accordingly. Wherever possible there should be a laboratory assistant trained to do the routine work, yet sufficiently appreciative of the results to call attention to irregularities so that operating procedures may be suitably adjusted.

In this connection we have observed startling inconsistencies in some reported results, particularly with respect to bulk solids. Appreciating fully the difficulties in obtaining representative samples, and having in mind the frailty of the personal equation, together with the inadequacy of laboratory procedure in certain determinations, such as volatile solids, it does not appear logical that solids should always be out of balance. With proper attention to details of sampling and technique of analysis, there seems to be no good reason why over a period of time results should not be consistent. It is difficult to understand why at the end of a year a report from one plant shows a gain in total sludge solids, whereas another shows an unaccounted-for loss of some 25 per cent. Similarly, a gas production of some 20 cu. ft. of gas per lb. of volatile matter destroyed in one plant appears inconsistent with only 10 or 11 cu. ft. as reported from another laboratory. Factors contributing to such discordant results require study and evaluation, and emphasize the necessity of basing final judgment on long-time results rather than on analyses covering relatively short intervals. Unless we can make laboratory work tell a true story it were better to devote that time to some other endeavor. However, it is our firm conviction that with proper attention to details of sampling, technique, and computation, correct results and reliable information can be secured.

The question arises to what extent experiment and research should be in-

cluded in routine plant operation and management. Where personnel and funds are available, all efforts to improve old methods and develop new procedures and processes are most highly commended. However, the urge toward the unusual or new should not sidetrack the routine essential to keep the old plant at peak performance. Little can be gained if the job at hand is neglected for the elusive bird in the bush.

Cost figures on the operation of sewage plants are often misleading and insufficient. The *Sewage Works Journal* of January 1932 carries a very comprehensive and complete report upon "Sewage Works Operating and Cost Records." To observe all the details there recommended, while desirable, is not always possible, especially with limited personnel, yet the basic outline should be followed. With most superintendents there is the tendency to show costs as low as possible. To do this, overhead is often omitted entirely, and special conditions in respect to free labor and other items are not always fully evaluated. In any event the gross operating cost, including overhead, labor, materials and supplies, should be included at going prices. Credits may then be deducted and the superintendent still receive acknowledgment for economies conceived and effected. If this be done, comparisons may be made without distortion due to local circumstances.

In sewage plant management, plant upkeep and maintenance are usually the first to suffer when funds are curtailed. It is relatively easy to put off until next year a needed coat of paint or some replacement where it is still possible to "get by." Such policy in the long run is expensive and leads to early total depreciation. Plant structures kept in repair and properly protected may have their useful life prolonged indefinitely. The matter of plant upkeep and maintenance is of major importance and a controlling factor not only in appearance but actual length of effective service.

Sewage plant records cannot be too detailed. A diary of daily events and happenings, while apparently inconsequential today, may be of major importance tomorrow. Records to be of value must be up to date. Not only chemical analyses, flow records and the like, but observations relative to wind, weather, odors or lack of odors, condition of receiving water, and anything pertinent to plant performance, should be duly recorded against the day of possible litigation, or for the benefit of those of the future who must plan extensions. The keeping of a complete up-to-date record of plant accomplishments is an essential part of a superintendent's duties and a prime essential to good management. Data should be recorded so that they may be converted to different bases such as per M.G., per capita, or other, depending upon the need in any given case.

When all is said and done, it is upon the plant attendant that the success or failure of sewage plant operation depends. Upon him rests the responsibility of detailed observations and measurements during routine work such as sampling, measuring sludge depths, recording temperatures, power readings, and numerous similar duties. To him the plant is entrusted during the night watches, and lapses in attention to detail may result not only in discordant plant results but frequently also in property damage and loss. It is essential, therefore, that the plant attendant be competent and trustworthy. A time clock cannot engender loyalty nor develop a sense of responsibility. This may be attained only by fair dealing and proper discipline.

The remarks made in this paper are not intended as a learned or detailed

dissertation on sewage plant management, but rather to provoke thought and discussion to the end that sewage plant administration may be made effective in producing maximum benefits of sewage treatment.

Proper plant management is not vested in any single person or department. It is a composite effort of state official, municipal executive, plant superintendent, and plant operator. Each has an important part, and when all are correlated, greatest effectiveness will be attained and the objectives desired from any plant are most likely to be achieved.

RELATION OF INDUSTRIAL WASTES TO SEWERAGE PROBLEMS

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THE SCOPE of the subject selected for study and report by the Committee is a broad one and little more than a general perspective has been undertaken. It is believed, however, that the generalized classifications adopted for the text basis of this report are sufficiently comprehensive as to afford a working guide to the solution of the more common industrial wastes problems encountered in practice. Special and unusual problems obviously may not be susceptible to such generalization as the broad term "industrial wastes" may imply, and depend for their proper solution upon detailed study and analysis.

Industrial wastes are subject to study initially upon the basis of their physical, chemical, biological, and germicidal properties, and secondly upon the possible effects of any one or a combination of one or more of these properties upon the sewage carrier system, the sewage treatment works, or the sewage treatment process.

Effects upon the sewage carrier system may be classified under the general headings of tendency toward deterioration of the materials of construction and the effects resulting from deposited suspended solids tending toward resistance to flowage and sewer stoppage. Similar effects may be anticipated upon and in the treatment plant structures and equipment.

Biological properties of industrial wastes may be reflected directly—depending upon the character of sewage treatment process—in added resistance to organic load oxidation with resulting increased cost of treatment, and, germicidal or toxic properties may be reflected in their possible effects tending toward lessening the biological activity upon which organic matter oxidation depends.

The extent of dilution afforded by the sewage volume into which industrial wastes may be discharged is obviously a factor of importance. Generally speaking, the greater the dilution, the lesser may be the tendency toward chemical deterioration of construction materials and equipment, and retardation of biological activity, in the event of treatment through the use of a biological process.

Frequently it may be essential, for reasons previously stated, that certain kinds of wastes be pre-treated at their source of origin before discharge into the carrier system, and among some of the most common are those produced by the following classes of industry:

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1. Tanneries (Leather and Fur Skin)
2. Packing Houses and Allied Industries
3. Paper Industry
4. Brewing Industry
5. Textile Industries
6. Gas and Coke Industries
7. Oil Industry
8. Steel Products Industries
9. Marble and Stone Cutting Plants
10. Acetylene Manufacturing Plants
11. Vegetable and Fruit Canning Industries
12. Rubber Industry
13. Paint Industry
14. Creamery and Allied Milk Industries

Laws and regulations have been found essential to proper control by municipal authorities of sewerage systems and sewage treatment works under their jurisdiction in so far as the matter of industrial wastes may be involved.

The Sewerage Commission of the City of Milwaukee, for example, is empowered under the statute which enabled its creation to regulate the character and quantity of industrial waste discharged into the public sewer system. Laws enacted by other states have granted similar powers to their municipalities, excerpts from some of which are herewith cited.

Section 7, Chapter 83, General Laws of Massachusetts, makes the following provision:

"If said department [Department of Health] determines after investigation that the unsatisfactory operation of a sewage disposal system is due wholly or partly to the discharge into the system of manufacturing waste or other substances of such character as to interfere with the efficient operation of said works, it may if necessary prohibit the entrance of such waste or other material, or may regulate the entrance thereof into the system, or may require the treatment of such waste or other material in such a manner as may be necessary to prevent its interference with the operation of the works."

Section 10, Chapter 83, General Laws of Massachusetts, provides as follows:

"The aldermen of a city or the sewer commissioners, selectmen or road commissioners of a town may make necessary regulations regarding the use of common sewers to prevent the entrance or discharge therein of any substance which may tend to interfere with the flow of sewage or the proper operation of the sewerage system or disposal works."

An ordinance for the protection of the sewer system exists in the City of Worcester, Massachusetts, and stipulates as follows:

"No person shall throw into any drain or sewer, inlet, manhole or catch-basin, any earth, dirt, stones, bricks, sawdust, ashes, cinders, shavings, hair, oyster, lobster or clam shells, or any other substance detrimental to the sewers or the use thereof. (Section 19, Chapter XXXIV.)"

"No live, exhaust or waste steam and no water of a temperature above 140 degrees F. shall be discharged into the public sewers or into any drain connected with them. (Section 11, Chapter XXXIV)."

A contract existing between the municipalities in the Passaic Valley Sewerage

District, and the Passaic Village Sewerage Commissioners, dated May 15, 1911, excludes:

"... all waste from gas works and all substances or discharges which might injuriously affect the integrity of the sewer or sewers when constructed."

The agreements between the City of Paterson and certain industrial concerns across the river from Paterson for discharge into the Paterson sewer system and Passaic Valley trunk sewer include the following stipulation:

"9. The Company hereby agrees to comply with all present or future rules and regulations of the City, concerning the character of sewage and trade wastes which may be discharged into the City Sewerage System, and the Company hereby agrees that it will at no time discharge into the sewer any liquids which contain oils, gasoline or any explosive or inflammable materials, or any substances which may be detrimental to or cause disintegration of the sewer structures; or any live steam, or excessively hot liquids; or any other materials which may endanger the life or stability of the sewer structures or which may endanger the life or health of persons within the sewer structures."

The City of Fostoria, Ohio, following serious trouble at the sewage treatment plant due to industrial wastes, enacted a protective ordinance from which the following excerpts are taken:

"Section 1. That it is deemed necessary for the safe, economical and efficient management and protection of the sewerage system, and sewage pumping, treatment and disposal works, that the emptying . . . of any grease, fats, oils, acids, carbon, iron or mineral wastes, or the wastes from any mercantile, manufacturing or industrial enterprise, other than domestic sewage, which would cause clogging, or which is injurious to said sewers, sewage pumping, treatment or disposal works, or interferes with the proper treatment of domestic sewage, or the operation and maintenance of the sewage disposal works shall be and the said is hereby forbidden and prohibited.

"Section 2. That the director of Public Service shall have authority . . . to require any and all . . . industrial establishments . . . to treat all . . . wastes . . . prior to the discharge thereof into the sewers or sewage system of said city, when he deems it necessary for safe, economical and efficient management and protection of the sewage system, and sewage pumping, treatment or disposal works. . . . When such . . . waste plant or device is installed, the degree of treatment shall be satisfactory to the Director of Public Service, and he shall have access to these local treatment plants at all reasonable times for the purpose of inspection and tests . . . whenever such . . . industrial enterprise . . . shall fail to comply with the requirements of the Director of Public Service, they shall forfeit their right to the use of such sewer or sewers, and the director of Public Service shall forbid and exclude the use of the sewers of said City for the emptying or discharge of such waste therein, until the same is treated according to the requirements and to the satisfaction of the Director of Public Service."

The city of Durham, North Carolina, has under consideration at the present time a form of ordinance containing regulatory powers applicable to wastes produced by the textile industry. This ordinance, in part, has to do with

pre-treatment at the source and with the matter of providing storage facilities through the use of which the rate of flow into the sewer system may be regulated. The proposed preliminary draft of the ordinance is as follows:

"Section 1. From and after _____ no industrial or other wastes that may be detrimental to the biological processes upon which the proper purification of domestic sewage depends shall be admitted to the sanitary sewers of the City of Durham.

"Section 2. No industrial or other wastes other than domestic sewage shall in any event be admitted to the sanitary sewers except upon a permit to be issued by the City Manager, said permit to be revokable at any time upon the presentation of satisfactory evidence that conditions under which the permit is issued are being violated.

"Section 3. A condition precedent to the issuance of any permit shall be ability to comply with the following requirements: (A) That no industrial or other wastes other than domestic sewage shall be discharged into the sewers at an hourly rate in excess of 25 per cent more than the average hourly discharge for a 24 hour day. (B) That such pre-treatment shall be given such industrial or other wastes as will comply with the provisions of Section 1, of this Ordinance, such proposed pre-treatment to be designated in the permit. (C) That any change in the method of treatment at any time that may be necessary to accomplish the desired purpose shall be evidenced by the issuance of a new permit. (D) Such pre-treatment shall include the neutralization of all caustic wastes and the adjustment of all wastes for alkalinity and biological oxygen demand to comply with such standard as the City may from time to time determine will permit the satisfactory operation of the Sewage Disposal Plant or Plants.

"Section 4. Any person, firm or corporation violating the provisions of this Ordinance shall be deemed guilty of a misdemeanor and upon conviction shall be fined not exceeding One Hundred Dollars or imprisoned not exceeding thirty days for each offense."

In extensive sewerage districts where industrial activities are numerous, varied, and complex, industrial surveys extending over considerable periods of time are means to tangible ends, in that through their grouping, classification, and adaptation, rather definite conclusions may be reached. Upon the basis of these conclusions general standards may be established, these standards serving as substantial guides relative to wastes admission to or removal from the sewer system, and as to the question of pre-treatment and its extent. Such standards of which the writer has first-hand knowledge have for a number of years been employed by the Milwaukee Sewerage Commission, and are enumerated in the following:

1. Removal from industrial wastes such solids as might tend to deposit in sewers.

2. Removal or pre-treatment of wastes containing active chemical constituents which through their activity tend toward destruction of construction materials and equipment such as pumps, valves, etc.

3. Removal or pre-treatment of wastes which may be deleterious either to the treatment process or treatment plant structures.

4. Removal from wastes of free oils, greases, tarry and resinous substances.

5. Removal of wastes of gaseous or inflammable character which may through their presence result in injury or death to men engaged in the work of sewer repair, maintenance, etc.

6. Isolating such solids as may be eliminated from wastes in manufacturing or pre-treatment processes, to prevent their later discharge to the sewer system as a convenient means of disposal.

7. Removal of all uncontaminated waters such as condensing water, cooling waters, yard and roof drainage waters, from the general sewage flow, and the diversion of same to storm water sewers or to natural water courses.

Pre-treatment of wastes for the removal of suspended solids is usually accomplished through the use of settling tanks with or without mechanical sludge removal facilities. Where the removal of hairy or fibrous matters is involved, stationary or revolving screens may be used. A combination of settling tanks and screens has been found suitable where the removal of both heavy suspensions and fibrous matters has been considered advisable.

Wastes carrying suspensions of high specific gravity such as those from stone and marble cutting plants and acetylene, carbide, and allied works, are susceptible to satisfactory treatment through the use of settling tanks. Because of the high specific gravity of the suspended matters, a high percentage of removal is essential to avoid subsequent sewer deposit.

Tannery beam house liquors have been successfully pre-treated initially through changes in beam house practice and subsequently through employing screens, either revolving or stationary, for the removal of fleshings, hair, and hide scraps. Long established beam house practice involved the use of low grade lump lime containing perhaps 60 to 80 per cent of calcium oxide, the balance being unburned lime, silica and other impurities which added substantially to the quantity of suspended matters discharged from the vats. The substitution of high grade dehydrated lime for low grade lump lime and the utilization of the vats themselves as settling tanks following the period of hide immersion, accomplished the desired results insofar as adequate removal of the heavier suspension was concerned. The deposits in the vats are removed to the dump and the supernatant as above noted is given screening treatment.

Pre-treatment of wastes containing free acids, such as pickle liquors from steel industries, wastes from engraving plants, metal plating works, storage battery plants and allied acid waste producing industries, may be accomplished through various methods of acidity neutralization. When neutralization is impracticable, and the condition in question so warrants, complete diversion of the liquor from the sewer is essential.

Acid wastes, aside from their destructive effects upon construction materials and metal equipment, may, if sufficient in quantity, lower the pH of sewage, thus tending toward offering resistance to its biological treatment. Metallic poisons, such as lead compounds, arsenic, etc., produced by the paint industry, if present in sufficient quantity may tend toward the establishment of a condition of toxicity with resulting retardation of biologic activity. Neutralization or diversion as may best conform to the condition in question obviously should be resorted to.

The tarry wastes from producer-gas plants and coke and gas works, have been found to be susceptible to satisfactory pre-treatment through precipitation

of the tar laden waters in settling tanks and filtration of the effluent through coke breeze filters.

Packing houses and allied industries such as sausage manufacturing establishments are producers of substantial quantities of oily, fatty and greasy wastes. The removal of these oils and fats is essential before the liquid wastes are discharged into the sewers, not only because of the unwelcome presence of this material in a sewage treatment plant, but also because of the tendency for it to adhere to sewer walls, thus reducing the carrying capacity of the sewer, sometimes to the point of complete stoppage. The installation of adequately proportioned grease traps not only results in effectively keeping the greasy substances out of the sewer system, but results also in a source of revenue to the plant owners who find a ready market for the grease thus reclaimed.

Oils and greases produced at hundreds of automobile service and gasoline stations are very substantial in quantity and would, if permitted to enter the public sewer system, be an endless source of extreme annoyance. It has been found workable and effective in the City of Milwaukee to have the greases and oils thus produced collected, when requested, by the Department of Public Works in tank trucks and stored in vats at the municipal incinerator for use in connection with the incineration of garbage. All oil pit drain connections to public sewers are ordered closed and city inspectors supervise the work of closing same.

Through the closing of service station drain pit connections to the sewers, it is believed that the presence of inflammables, such as gasolines and volatile oils, in the sewers, is to a very large extent removed.

Wastes from canning industries, if appreciable in quantity in relation to the sewage volume into which they are discharged, may substantially increase the composite sewage B.O.D. and resulting cost of sewage treatment. Pre-treatment of the wastes in plain sedimentation tanks is effective in reducing its demand for oxygen.

A matter of considerable importance is that of the pre-treatment of sulphite waste liquors produced by pulp mills, in the paper industry, and in which bio-chemical oxygen demands may exceed, and frequently do exceed, 20,000 parts per million. In municipalities where paper making is a major industry as in the Fox River and Wisconsin River Valleys in Wisconsin, the matter of discharging a waste possessing such an intense affinity for oxygen into a public sewer system, for treatment in a biological sewage treatment plant, is nothing short of appalling and is hardly susceptible to economic justification upon any basis which might be assumed for the purpose of discussion.

The health department authorities of the State of Wisconsin have intensively studied the question of paper mill wastes, their effect in stream pollution, oxygen consumption properties, and effect upon fish life, and have directed as follows: (See Special Report of January, 1927).

"(2) With reference to industrial wastes, primary consideration is given in this survey to those from pulp and paper mills. Pollution from the other industries is relatively immaterial and, in the main, such that they can be taken care of with the domestic sewage of the municipalities. With reference to the paper industry, the following program, where not already started, should be initiated without delay:

(a) Equipment for the recovery of fiber wastes so that not more

than 0.5 pound of paper making material per thousand gallons of effluent is wasted, should be installed.

(b) Because the sulphite waste liquor is the greatest factor in reducing dissolved oxygen of a stream, energetic and continuous research should be carried on to develop recovery processes that will satisfactorily eliminate these wastes as a serious factor in the pollution of streams.

(c) Although not so high in oxygen demand as the sulphite waste liquor, the considerable volume of the sulphate waste liquor makes it necessary that attention be given to improved recovery processes or methods of operation that will eliminate these wastes as a material factor in stream pollution.

(d) In all other branches of the paper industry every effort should be made to so revise equipment and methods that stream pollution will be reduced to a minimum."

Engineers and municipal authorities may be and frequently are confronted with unpleasant tasks involving matters of reconciliation between extent of pre-treatment desired by them and that which a manufacturer producing an undesirable waste may be willing to subscribe to.

It has been suggested in this connection that charges for sewer and sewage treatment service to one or a group of manufacturers be determined upon the basis of industrial waste B.O.D. in its relation to the B.O.D. of the total composite sewage of which it may form a part. Such a method obviously might constitute an unwieldy and unsatisfactory tool to apply. The better solution would appear to be that of adequately empowering the proper authorities through legislative enactment to establish and enforce such provisions in the matter of pre-treatment situations as might be considered susceptible to justification upon an equitable and economic engineering basis.

DISCUSSION

MR. R. L. PHILLIPS (Meadville, Pa.): We are contemplating at the present time the passage of an ordinance prohibiting all forms of industrial wastes except by special permit. I understand this is done in several places. We have felt for some time that the ordinary tax rate is certainly no basis for distribution of the cost for the treatment of industrial waste. You may have an industry in your community which represents only four or five per cent of the pay roll of the locality or less, which contributes a waste to the sewer system that might constitute fifty per cent or more of the cost of sewage treatment. That is an unjust distribution of the cost.

The other method provides for the special pre-treatment of each individual case, or, in other words, the fitting of that waste for entrance to the city sewer system. I think it is only fair and equitable that we have some sort of distinction. We have one industrial plant which discharges a small quantity of acid waste, and that industry is utilizing that waste at the present time.

MR. S. SHUPPE (Kitchener, Ont.): Most industries are already entering into that procedure and requesting special permits. In our municipality we find that the canners and other such wet industries distribute over half the total sewage and we were contemplating the installation of a refined screen in the manholes on public property where it enters, or a screen consistent with the type of waste so that unless they kept that waste in a proper manner, the flooding or the result of trouble would first come upon themselves. That may be high-handed

as some industries are already doing their share while others apparently give us bad accumulation in the sewage.

MR. W. W. DEBERARD (Chicago, Ill.): There is one phase of industrial waste I don't think Mr. Townsend covered. In a way, it is not a waste, but it is the matter of the very rapid increase in the use of water for air conditioning. In Chicago water use has increased very materially in the down town area, and Lincoln, Neb., has flooded out its sanitary sewers absolutely. An ordinance has just been passed there requiring all air conditioners to be connected through a storm sewer system which has plenty of capacity throughout the year. The sanitary system, if it were enlarged to take care of that, would cost three quarters of a million dollars or more. I think that there are many other such cities that have the same problem. In many cases you have to pump the additional water when it gets to your sewer system, and the dilution of your sewage at the disposal plant, if there is one, is quite a problem, for it affects, of course, your biological condition.

I think that addition to the number of wastes Mr. Townsend has enumerated, what he is going to do about it, etc., should be included by the Committee in one more paragraph.

CHAIRMAN HOWE: It is going to be a more serious problem in the future than today, but I know in our own city the growth of air conditioning, not only in private office buildings and the new city buildings being constructed, but in private homes as well, has been rapidly increasing.

MR. A. WOLMAN (Baltimore, Md.): I would like to suggest a further addition to the Committee's report. I think the report properly should include the installation of domestic garbage grinders on the household fixtures, of which there are at present only a few experimental installations. Doubtless where municipal ordinances do not prevent their installation they would be multiplied considerably in the next five or ten years. That is a topic on which there has been much discussion in the sanitary field without much conclusion.

In Baltimore they are prohibiting them at the moment except by special permit. They are in a similar class with the type of installation which Mr. DeBerard just mentioned. Baltimore's city ordinance for some years has prohibited the return of cooling water from air conditioning plants, domestic or commercial, through the sanitary system, but demanded its return to the salt water system. In the case of Dayton, Ohio, my attention has been called to the fact that it is depleting its underground supply of water, and overloading the sanitary system. In that case there are some instances where the owner or installer of the air conditioning system is being required to return the domestic water supply to a new well system. In other words automatically requiring them to return it to the underground water system. That is not applicable in our territory, however, where the surface supplies are the major sources.

MR. P. L. BROCKWAY (Wichita, Kan.): The last comment about returning the water to the well is very interesting, but it so happens that in my city it is only ten feet to water. Even during the extreme drought we have been very lavish in the use of it by the installation of pumps, but they started running the sanitary sewers, and the sewers will not carry it. We are required now to connect it with the storm sewers and this summer when we had temperatures fairly high for quite a long time, it began to deplete the ground water. In a meeting with building operators it was suggested by them that an ordinance be passed requiring them to return that supply to wells. I suggested as a counter

proposition that they try it out first as there is a possibility that it may raise the ground water temperature so that it would be unsatisfactory, and they said they would try it out. Well, I learned later that a new well had been opened up and the owner got water from the well which was ninety degrees in temperature.

CHAIRMAN HOWE: Where wells are used for drinking water as well as air conditioning, isn't there a hazard in returning the water to underground sources?

MR. BROCKWAY: About a year ago someone in the Health Department issued an order that the cooling water should not be returned to the wells and when this situation arose about the lowering of the ground water table to a point that they were going to be put out of business, we were not able to find the individual in the Health Department who issued the order, and it was waived, at least for the present.

However, I think a return of water to the ground from buildings can be serious. For example if you have a building operator or building engineer who will make cross connections of almost anything, you may have a very serious pollution unless it is taken care of properly.

MR. ABEL WOLMAN (Baltimore, Md.): I would like the record to show that the statement with reference to the return of air conditioning water to underground sources was given to me by one of the consulting engineers of Dayton, Ohio. I feel that it should be practiced with the greatest amount of caution, and I know of no state board of health which has either sanctioned or permitted it as a general practice. It is certainly one of those debatable things that should be decided in the future. I mention this as merely an interesting aspect of the same problem.

CUSTOMER ACCOUNTING PRACTICE OF THE DETROIT DEPARTMENT OF WATER SUPPLY

HAL F. SMITH

Department of Water Supply, Detroit, Mich.

THERE is nothing spectacular about the customer accounting system of the Detroit Department of Water Supply. If it deserves a place in the sun, it is due solely to the fact that it does the job it was designed to do, accurately, thoroughly, and economically.

The Detroit Department of Water Supply is a municipal department, operating by authority of the city charter, which bestows upon it the right of lien as security for its charges for water service, which fact influenced to a considerable extent the design of its customer accounting plan.

This department now has 274,000 customers' accounts, which are practically 100 per cent metered.

Application for service is made by a licensed plumber, acting as agent for the owner. Upon application and receipt of service installation fee, the department makes the tap and extends the service to the lot line and installs a control box. The plumber does all the work inside the lot line under the supervision of this department, the Board of Health, and the Department of Buildings and Safety Engineering.

The customer's account is opened at the time the service tap is made. A meter reading sheet is prepared, using the tap date as the beginning date for service charge. The meter reader inspects the property while covering his route and reports conditions. The plumber is expected to notify the department as soon as ready for meter installation, but if he fails to do so, the meter reader discovers it and so reports. The meter is then installed and a meter installation report forwarded to the meter reading bureau, where it is entered to the reading sheet and sent to the addressograph section where an addressograph plate is made. Before filing the plate, it is used to head up the customer's ledger card. The ledger card is then held in file until the first reading of the meter is obtained.

The account is then ready for preparation of the initial bill, which is computed as follows: the account is charged at construction service charge rate from date of tap to date of meter installation, and at metered rate from date of meter installation to date of reading, in the amount indicated by the meter. The construction service charge is a flat rate based on the size of the service line and is intended to cover the charge for service rendered during construction of the building. The construction service charge rate is applied to all services of 1½ in. and under. The charge applied to larger lines to cover charge for service from the date of tap to the date of meter installation is known as a building tax. It is based on the size and kind of building erected and is in accordance with an adopted schedule.

This method of opening an account makes certain that an account is opened for every tap and quite satisfactorily provides a method of billing for service rendered prior to meter installation.

All customers' accounts are billed quarterly, except those covered by 4-inch meters and larger, which are billed monthly. For the purpose of reading and billing the quarterly accounts, which are over 99 per cent of the total, the city is divided into thirty-six districts, which allows a little less than two days for the reading of each district. We are operating on a cycle plan, in which our schedule provides a period of approximately two days for the completion for each district of each operation, such as reading meters, checking readings obtained and entering skipped readings, preparing bills, proving computations, delivering bills, and the various operations of the collection routine. Under this plan, all operations are in progress every day, thus assuring an even flow of work and eliminating peak loads at any point.

The customer accounting system used by this department is the combination bill and ledger plan. Public utility billing machines are used and are so designed as to print the bill and at the same time make a carbon impression of the bill on a proof sheet and then by a repeat-print operation, to post the same items to the ledger card, thus assuring that the items posted to the bill, proof sheet, and ledger card are identical.

In order to explain the customer accounting plan, it is necessary to explain the forms used, but as a verbal explanation is both lengthy and unsatisfactory, we have prepared a photostat copy of the principal forms used and have here placed them on display for all who may be interested. These forms have been prepared in such a manner as we believe will clearly explain the various operations of the customer accounting plan, as well as its tie-up with the controlling accounts and general ledger.

It might be well to explain at this time that each of the thirty-six districts is divided into meter reading routes of such size as to constitute one day's work for one reader. The reading sheets for these routes are arranged in order best suited for meter reading purposes and are locked into a binder which is opened only for the addition of new accounts. Corresponding ledger cards and addressograph plates are arranged in the same order, all of which are covered by an alphabetical index of streets, which shows at a glance the district and route number of any account. Accounts are known by address only, for the reason that the charge is made against the property rather than any individual.

Each meter reading route consists of approximately 170 meters and is used as the unit of all operations. All operations are made in accordance with a pre-arranged schedule. A brief statement of the principal operations of the plan given in chronological order will, I believe, clarify the picture.

1. *Meter reading.* Readers report to the office each morning and are assigned a reading book. Readings are obtained during the day and the completed book turned in the following morning.

2. *Office check of reading books.* Clerks go through the reading books looking for abnormal consumptions, skipped readings, and at the same time verifying the reader's computation of consumptions. These clerks also write up "pick-up" slips for re-reads, investigation of abnormal consumptions, and skipped readings.

3. *"Pick-up" readings.* The "pick-up" slips made out in the previous operation are turned over to the "pick-up" men. These "pick-up" jobs are completed during the day and turned in the following morning.

4. *Entering "pick-ups."* The obtained "pick-up" readings are entered to

the reading sheet and where no readings were obtained, the consumption is estimated. Reading books are held, if necessary, for a third attempt to get the reading. Completed books are then sent to the billing section.

5. *Bills are addressed* by addressograph machines and sent to the billing section.

6. *Ledger cards* for districts to be billed are sent to the billing section.

7. *Bills prepared.* To each billing machine operator is assigned a reading book with the corresponding ledger cards and pre-addressed bill forms. Bills are prepared as previously described.

8. *Audit.* Completed bills, together with abstract sheets and ledger cards, are sent to the internal audit and control division for audit. Here the bills are proved for accuracy of computation, the total of miscellaneous charges for each controlling unit is checked with predetermined totals and the total of arrears items checked with unit control totals. Proved abstract sheet totals are posted to the controlling accounts. Bills are then released to the delivery clerk.

9. *Preparation of bills for delivery.* All bills are delivered to the premises unless requested otherwise by the owner. About two-thirds of our bills are delivered to the premises. These are delivered by our own men. The remaining one-third are mailed to the owner or to such other person or company as is by him designated. The fact that we so mail about 100,000 such bills to about 45,000 different owners each quarter, with a constant change in both the accounts concerned and the owners listed, has made it necessary to install quite an elaborate mailing list system, but time prevents a description of this plan. Suffice it to say that the delivery clerk pulls all bills that are to be mailed and mails them, sending the balance to the meter reading bureau, where they are turned over to the bill distributors for delivery. The delivery clerk also attaches a delinquent notice form to each bill carrying an arrears item.

10. *Cash posting.* Water bills may be paid at the main office of the department or to any of the sub-agents of the American Express Company with whom this department has a contract. This procedure has established 550 neighborhood collection agencies, scattered throughout the Detroit district. All payments received on any given day, including returns by the agents, are posted to the customers' ledgers the following day. This is made possible by running a night force, who receive all cash stubs that are paid during the day. These clerks sort the stubs to ledger order, pulling ledger cards from the inactive districts and running a recap tape of the cash stubs to balance with the cashier's total and to establish a pre-determined total for each controlling unit. The stubs are therefore all ready for posting the following morning. Cash is posted to the ledger cards by means of cash posting machines, which post cash to the ledger cards in red figures and run a tape, showing transfer totals for each controlling unit and a grand total for each district. The operator checks the control totals with the pre-determined totals as she progresses with the work, with the result that at the end of the day there is no question as to the balance, for the simple reason that each operator has been in balance all day. The recap tape is checked with the cash posting machine tape and sent to the internal audit and control division for entry to the controlling accounts.

11. *Penalty posting.* Ten days after due date, the 5 per cent penalty charge for late payment is posted to the customer's ledger. This is posted by means of a machine identical to the cash posting machine, except a black ribbon is used. Penalty is posted in the manner shown on the display board. Transfer

totals are taken at the end of each controlling unit and these totals sent to the internal audit and control division for entry. The collection division of the department is geared to the customer accounting bureau and comes into mesh at this point. While the clerk who posts penalty is going through the accounts, he sets aside all the ledger cards that are carrying an unpaid balance of over \$1.00, thus establishing the delinquent list.

12. *Collections.* The cards set aside by the penalty poster are turned over to the office section of the collection bureau, where past due bills are typed for all accounts carrying delinquent balances under \$5 and delinquent bills typed for all accounts with balances over \$5. The past due bills are mailed to the customers, but are not followed up by the field force of the collection bureau. Delinquent bills are typed in triplicate, one copy being retained by the office, for office and field follow-up, one copy mailed to the premises, and one to the owner, if the owner does not live on the premises. The delinquent bill also serves as a notice of shut-off. Time does not permit a description of our collection routine, but the principal forms used are posted on the display board.

13. *Adjustments.* All entries to the ledger card, made at any time other than the scheduled time for that particular operation, are considered adjustments. All items posted to the control, at the scheduled time are reported to the control by proof sheets. All entries made at any other time are reported to the control by adjustment slips. Under the classification of adjustments, then come: final bills, special bills, cancellations, refunds, transfers, and sundry debits. All adjustments are handled by the adjustment clerk, who makes the required entries to the card, writes the adjustment slip, thoroughly describing the transaction, and presents it to the head of the bureau, or his assistant for an O. K.

14. *Internal audit and control.* It is generally agreed that a customer accounting system that is not under complete control, and in balance both internally and with the general ledger, cannot be considered satisfactory, no matter how well it appears to be operating otherwise. Our control ledger is entrusted to a senior clerk, acting as control keeper. A master control consisting of 40 controlling accounts, one for each of the thirty-six districts and four for other divisions peculiar to this department, is maintained. This ledger is arranged to show a daily revenue distribution, cash receipts, and balance outstanding. It is a daily summary of all entries made to customers' accounts. The control keeper receives his data from proof sheets and adjustment slips, as above described. A mathematical proof of control entry has been worked out and is applied daily, proving that entries are made in the correct amounts, and to the proper accounts. Each of the district controlling accounts represents about 7500 customers' accounts. This is, of course, too many for balancing purposes, so a control was set up for each reading route, consisting of approximately 170 accounts. Since we have at present 1,756 reading routes, it means that we have 1,756 of these sub-controlling accounts, known as route controls. To these controls are entered only the balance at the last balancing date and the total daily debit and credit items. If this control is accurately kept, it will show balance outstanding in the corresponding route for any given date. If it were known that no error would ever be made to either control or ledger card, trial balances would be unnecessary, but we all know that in spite of all precautions taken to prevent them, errors will occur; hence a periodical trial balance is essential.

Running a trial balance of customers' accounts is often considered a difficult

and expensive operation; it formerly was for us. It is now one of our simplest operations. You will recall that all unpaid balances are posted to the current bill, hence to the proof sheet. The sum of the individual balances for the route is then the outstanding at that time and should check with the control. If it does not, we have only 170 accounts to check. The error is found in a few minutes, corrected, and the controlling account is balanced. The small control unit and the cycle plan of balancing have made this possible. The route control is kept in balance with the master control which, in turn, is kept in balance with the general ledger by means of a monthly trial balance.

The abstract sheet contains a great deal of information readily available for statistical purposes. The compilation and tabulation of these data are daily routine operations, the result of which is shown in the Customers' Accounts Bureau Annual Statistical Report.

RECORDS AS AN AID TO OPERATION OF A WATERWORKS PLANT

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EFFICIENT operation of a waterworks plant is impossible without records. They measure progress and show its direction, and give warning of wrong methods, unwise procedure, and inefficient operations. Attention is drawn to extremes; the way is shown to short cuts, and waste is located.

Records themselves are of little value. It is the data they supply and the use to which they are put that establishes their value.

They should be summarized often, and at regular periods, and put in such shape that their meaning can be seen with very short study.

Records manually made are not usually as reliable as those made automatically by recording gauges, and these latter instruments should be used when possible.

Each waterworks plant makes certain operating records that are especially significant in its own case, but there are some records that every plant should have. Most important is the amount of water delivered to the distribution system, and this should be automatic, giving the rate of pumpage at every instant, together with the total for the day. This will be a record of the manufactured product of the plant and on it all costs are based.

A study of the daily pumpage will determine if there is undue waste. For instance the average rate of pumpage between midnight and six o'clock in the morning in months when there is no lawn watering or freezing weather should not be more than 15 per cent of the maximum rate during the balance of the day. If it exceeds this figure by very much, then it is evident that there is considerable leakage in the system.

Recording pressure gauges in the pump house and at various points in the system are very useful. The gauge in the pump house will be very useful in settling disputes as to water pressures at fires, and also as a check on the operators. The gauges out on the system will provide data as a basis for strengthening or rebuilding the mains.

At the pump house, records will be kept of all the operations here and care should be taken that they are all of use. Voluminous records and complicated charts are not to be desired. A judicious weeding out of all records found to be non-essential would be advisable in many pumping stations. A record of the cost of operation of pumping machinery, for instance, will often lead to economies, and sometimes point out the advantage of replacing the unit with one of more modern design. Where electrical power is purchased, often a considerable economy can be secured by operating certain units in the proper manner and at the proper time. Adequate records are valuable in this case.

At the filter plant, records having to do with the amount of water filtered, chemicals, and power used are necessary. The bacteriological and chemical characteristics of the raw and filtered water will be recorded, and from these the efficiency of the purification process determined.

The possession of good records has helped many a waterworks superintendent-

ent when aspersions are cast on the service or quality of the water. Sudden outbreaks of dysentery, or other diseases of that kind will be first blamed on the water supply, and unless the superintendent has a record showing that the quality is up to standard, he will have difficulty in proving that the waterworks system is not to blame.

In every city there are always those persons who periodically discover some taste or odor in the water. These complaints are sometimes genuine but most of them are based on hallucinations of one kind or another. A proper record will usually be instrumental in persuading the complainant that nothing serious is wrong.

Governmental commissions have done good work in requiring annual reports from waterworks systems giving records of all kinds, and thus guiding the superintendent in setting up a new system. Waterworks associations have also undertaken similar activities with excellent results.

ENFORCEMENT OF CROSS-CONNECTION REGULATIONS

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IN EVERY city there exists a considerable number of private water supplies. Most of these obtain water from adjacent streams or wells. Such private supplies are resorted to because no other water was immediately available, or with the erroneous idea that the water can be thus obtained at less cost than to purchase it from the public waterworks. Since the advent of air conditioning, well supplies have been found desirable because of the lower temperature of ground water for use during the summer months. Underground water supplies are usually too hard for steam and hot water purposes without softening. This latter requirement makes its use an added cost.

The weakness of private supply systems lies in the fact that they may not be reliable in continuity of service and in their inadequacy as to quantity or availability for efficient fire protection. Where the public supply is suitable for steam use, and the private supply is a hard water, another disadvantage may be present. For these reasons it has been desirable for consumers to interconnect private water supplies with the public supply as a standby for adequate fire protection and as a safeguard against interruption of service due to breakdown, and also for partial use of the public supply where there are advantages in its use.

Such interconnections have been customary practice in all cities for many years. Where the quality of the water could be relied upon to produce no sanitary menace to the public supply, the cross-connections have not been considered hazardous. With the raising of standards of purity of public water supply these interconnections have, however, become objectionable. Most cities now distribute purified or chlorinated water, while private water supplies usually are untreated and in many cases seriously polluted. The menace of such cross-connections then became fully recognized and regulations were drawn to prohibit their existence. The most potent objection to such procedure was from the underwriters who were loath to consent to the removal of a direct supply of public water into private fire fighting facilities.

The first step in the removal of cross-connections for the protection of a purified public supply was prohibitory legislation. This resulted in the elimination of direct connections, but the pipes were left in such condition that an emergency reconnection would readily be possible in a few minutes if required. In other cases double checks and valves were resorted to without actually breaking the pipe line. These devices, however, have proved wholly inadequate. Valves and checks are subject to leakage, and reconnections made were usually left in place until the next inspection revealed their establishment. They also have the disapproval of sanitation officials.

The frequent requirement of a reconnection of the public supply into the premises where a private well is the source of water has made it necessary to provide more adequate service without the possibility of back flow. Such connections generally work to the detriment of the water user, by lessening the

water pressure under certain conditions or causing him to install extra piping, tanks, and in some cases pumping equipment. Since he is not a regular water customer he should not object to these requirements in order to have the advantages offered by the public water supply.

A public water supply connection that will not permit back flow must consistently conform to the following regulations: "No physical connections or openings for making physical connections between the public water supply and a private supply shall be permitted to exist. Where premises are supplied with other than the public supply and it is desired to use the public supply wholly or in part on the premises, the public supply shall be discharged into a supply tank by an independent overhead pipe terminating in an opening at least six inches above the top or rim of the tank, and under any condition shall be sufficiently high to prevent back siphoning. The tank shall not be located where it will be subject to flooding or below ground level. Plans and inspection shall be approved by the City Engineer. Premises found to be using water by direct interconnection to the private system shall be shut off in the street, and shall not be turned on until these regulations have been complied with."

It is common practice of cities to make regular inspections of interconnected services. Where existing connections are uncoupled and not in use, no effort is made to enforce the regulations since the owner might claim that he is not using city water, and therefore the municipality would have no jurisdiction in the case. However, if the owner is found with an actual connection and using public water he is a violator of the regulations and the penalty is to deprive the premises of public water until the requirements are met.

There are of course modifications of these conditions that will arise and require special attention and treatment. A certain building may have a supply of water from a well for air conditioning only and desire the public water for boilers, hot water, and general plumbing fixture use. It would be necessary that the two systems be independent and accessible for inspection to prevent interconnection. Such arrangements or similar ones will require constant attention by municipalities in order to keep them in the condition necessary for the safety of the public. Connections made as provided by the regulations cited should be constructed in a clean sanitary location so that foreign matter will not be introduced into the water. When so constructed they will permit the use of water both from private sources and from the public supplies without inconvenience to the user or danger to the community.

Cross-connection regulations will without doubt become more stringently enforced in the future in accordance with the realization of their importance as safety measures in protecting the health of urban population. The principal force to be applied is the power to deprive premises of water until service arrangements are properly installed. Likewise regulations must be such that all premises may be served in accordance with all sanitary requirements.

INCINERATION OF REFUSE AT TORONTO

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DURING the past forty-six years, the disposal of garbage and combustible waste within the City of Toronto has, to a greater or lesser extent, been effected by the process of incineration. In the year 1890 the first incinerator or crematory, as it was then known, was built and placed in operation. The plant consisted of a frame building with a wooden ramp approach, housing two small natural draft furnaces, and a steel chimney located in the center of the building and connected to the combustion chamber of each furnace. In those days the material was delivered to the plant by horse-drawn, two-wheeled, rear dump carts, having a capacity of about two cubic yards. The material was dumped on the wooden tipping floor, which was level with the top of the furnaces, and forked from that point into the furnaces through circular charging holes. It then dropped directly to grates below, and with the assistance of additional heat provided by five coal grates (three of which were located at the front of each furnace and one at the center of the sides of each furnace), the material was destroyed. The residue was drawn off the grates through doors at the grate level, deposited into wheelbarrows, and dumped outside the building. Sixty-five to seventy cart-loads of mixed refuse per day was considered an average day's run. The plant was operated by one foreman, eight men, and a watchman: and the population of the city at that time was approximately 150,000. This plant, it is understood, was operated until the year 1902 when it was closed down because expensive repairs were necessary. The material formerly destroyed by this plant was dumped in a large water and marsh area in the southeast section of the city. The plant was later dismantled.

In the year 1898 a plant of similar design, but somewhat larger in capacity than the one previously described, was constructed in the southwest section of the city. The capacity of this plant was built up to approximately eighty tons per day of sixteen hours. The furnaces were equipped with coal grates located at the front end, which were used continuously in early years, but during the last ten years of operation no supplementary fuel was used. The operating staff engaged in the plant consisted of a foreman, sixteen laborers and a weigh clerk. During the year 1903 the interior of the furnaces was improved by the construction of a longitudinal firebrick wall, which supported a series of nine-inch transverse drying arches extending from the sides to the center wall. The plant was partially destroyed by fire in 1913, when it was rebuilt and continued in operation until the end of 1924, which year marked the starting of the Wellington destructor, beginning the year 1925. The old plant was later torn down.

The foregoing briefly describes the type, capacity and operation of plants previous to 1917. With the exception of the amount of mixed refuse destroyed by the Western crematory, garbage, rubbish, and incombustible waste was dumped at the Ashbridge's Bay site in the southeast section of the city, and at many other dumping points scattered throughout the city, most of which were located in close proximity to residential districts. These dumps

were being filled with such rapidity up to the year 1912 as to alarm civic administrators. Further, it is quite obvious that the citizens, especially those residing in the vicinity of these many disagreeable dumps, voiced in no uncertain tones their disapproval of this antiquated as well as extremely unsanitary method of disposal. As a result, serious consideration was given to the subject together with exhaustive study and investigation for the purpose of recommending methods for sanitary, rapid, and economical disposal of the city's domestic waste. The population of Toronto in 1912 was 417,250.

Under date of February 19, 1914, the late Geo. B. Wilson, then Street Commissioner, presented to the chairman and members of the Committee on Works of the City Council a complete report following a careful study of the refuse disposal problem then confronting the community. Extracts from this report follow.

Present Methods of Disposal

The problem of determining the best method of disposal of Toronto's waste, having due regard, first for sanitation, and secondly for economy, has received most careful consideration by this Department.

Of the prevailing practice of garbage disposal, one can only say, aside altogether from the question of sanitation, that it is at once primitive, uneconomical, and undesirable. There remains, however, no alternative but to continue it until such time as a proper system of disposal can be inaugurated.

Since to complete and place in operation the plants recommended for adoption, or indeed to carry out any of the projects considered, will consume over two years, and perhaps three; that new dumping grounds are no longer available; and moreover that we can only hope to retain Ashbridge's Bay for a further brief period for dumping purposes, it is obviously imperative that no delay should be lost in reaching a decision as to the method of disposal to be adopted.

Reasons for Improvement

Coupled with the present method of disposal, and equally unsatisfactory, is that of collection. The carts now in use by the Department are, in the main, not only unsightly but positively unsanitary, and uneconomical, in addition to which the overloading of them, which is rendered necessary to economize as much as possible, results in the scattering of their contents to no inconsiderable extent along the public thoroughfares. The installation of proper collection equipment is dependent, however, upon the method of disposal adopted, and can, therefore, only be satisfactorily dealt with after this is determined.

Conditions when Present Department Organized

The question of garbage and refuse disposal received considerable attention at the hands of Mr. R. C. Harris, during the brief period the service was under his control. The subject was reported upon by Mr. Harris in November 1912, and as a result of his recommendation, a By-law authorizing the expenditure of \$1,000,000 was submitted to and approved by the ratepayers in January 1913. The matter remained in abeyance until the reorganization of the present Department in May last.

Scope of Studies

In order then to determine the most sanitary and economical method of collection and disposal, a series of exhaustive studies was first made by the Department, obtaining in the city and its environs.

These embraced the following:

1. Topography of the city with reference to its influence on collection.
2. Inspection of all sections of the city with reference to its layout, and the influence of same on collections.
3. Inspection and study, with reference to advisable locations for disposal plants, or central loading stations from which refuse can be transferred by means of steam railways, trolleys, or motor trucks.
4. The present methods of collection, with reference to improvement, not only in methods, but also in sanitation and economy.
5. Study of special data; data on file and of reports made to the city by Dr. Rudolph Hering, and Mr. Ray Knight for the present Commissioner of Works.
6. Study of the present work of the Street Cleaning section of the Department, with reference to the influence of the work of street cleaning on the collection of refuse.
7. Time studies of work now performed, and comparison of available data for Toronto with data in other cities, to determine the approximate quantities of each class of refuse produced per annum, or per capita per annum.
8. Study of past growth of city with reference to future growth, and compilation of charts and tables relative to same. Estimates of future growth at five-year periods to 1928.
9. The studies of the Assessment Commissioner for past years, and their relation to future growth.
10. Preparation of maps showing population in wards, subdivided into districts, and estimated population for five-year periods up to 1928, for each district, from which the production and estimated production of the different classes of waste for each district was made; also tables (to agree with maps), giving quantities produced in each district; and length of haul to assumed points of disposal, from which the cost of collection for various years was computed. Studies also made relative to the influence of future growth on the cost of collection, and the length of haul.
11. Studies of tables compiled in Assessment Department relative to vacant frontages in various wards, with reference to future growth.

Methods of Disposal Considered

1. Total incineration of all garbage and rubbish, and such quantity of ashes as required for their fuel value, the bulk of ashes being disposed of as fill.
2. Total incineration of rubbish and reduction of garbage, with ashes disposed of as fill.

Application of Studies Made

In making the present studies, we have taken into account the future growth of the city, estimating the population at various periods, during

the life of the plant. We have also computed or determined the capacity from the maximum daily collection of refuse made in the month of maximum production, a percentage of which will hold more or less constant relative to the amount collected in any one year.

The problem presenting itself for solution is found particularly difficult, inasmuch as the city is built up in sections where logical sites for disposal plants would naturally suggest their location from topography studies and density of population.

In considering the method of total incineration in high temperature furnaces, the combustion gases, where possible, should be used in generating power, but due to the price at which electric current is furnished by the Hydro Electric Commission, it is not feasible to generate electric current from power that can be developed in the refuse furnaces, since to do so would not warrant the additional first cost of installation, or increased cost of operation. It has not been possible to find any outlet for the utilization of steam, inasmuch as at such locations as the quantity produced might be profitably utilized, the demand would not be constant. Again, where the demand would be constant, suitable sites are not available for the installation of furnaces.

Projects Recommended Showing Estimated Capital Costs

A. Total incineration of all garbage, rubbish and part of ashes, in two, three, or four disposal plants. \$480,000.

B. Total incineration of rubbish in two incinerators, and reduction of garbage outside city. \$676,000.

C. Total incineration of rubbish, and reduction of garbage in central plant located in city at Ashbridge's Bay. \$720,000.

The City Council, after careful consideration and much deliberation, authorized project A, namely: total incineration of all garbage and rubbish as the method of disposal; and the Commissioner's report was passed in Council on September 9, 1914. Following the authorization by City Council, specifications were prepared for the construction and erection of a modern high temperature, mixed refuse destructor plant, to be located in the eastern section of the city. The plant was constructed, completed, and placed in operation early in 1917. The capital cost of the Don plant, including buildings, approaches to and from same, three high temperature furnace units, with flues, one radial brick chimney, and all appurtenances, amounted to \$225,000. The guaranteed capacity was 180 tons per day of 24 hours. Following a series of prescribed tests, the plant was accepted by the city from the contractors in July of that year.

The advent of the mixed refuse, high temperature destructor in Toronto was marked not only by local interest, but by officials of sister municipalities, as well as in other fields. Engineering and municipal deputations from many large cities in Canada and the United States were interested to the extent of visiting and carefully examining the system. Further, the *Contract Record and Engineering Review*, with head office in Toronto, under date of August 15, 1917, published the following editorial, "Toronto's Garbage Destructor Plant."

Garbage disposal is one of a community's most important problems. The effective removal of the refuse and wastes collectively grouped as garbage is, in the last analysis, just as necessary as effective sewage disposal. Sani-

tation considerations should no more tolerate the fermentation and rotting of garbage refuse than it should approve of the pollution of water supplies by sewage wastes. The wonder of it is that ineffective modes of garbage removal and disposal have been so long rampant. Most cities are wide awake to the need of purification for their sewage; most have comprehensive sanitation and health legislation, and yet few seem to realize that the putrefaction of household wastes is a dangerous menace to public health.

The dump is the most extensively employed scheme for the disposal of garbage, but expediency appears to be its chief merit. The aesthetic instincts of a community, if nothing else, should react against a public dump. Its unsightliness, the odors of decomposition, and fermentation of its contents, are all further arguments for more efficient disposal. The dump is warranted only when ashes form the greater share of fill. The practice of gathering household wastes and ashes together is not to be commended. Ashes make good fill; household wastes never.

For those municipalities that wish to undertake more effectual measures than mere dump, complexities, of course, arise. The very fact that garbage contains organic matter with high oil and grease content opens the way to a process of reduction whereby these ingredients may be recovered and sold at a profit. Incineration or total destruction by burning, however, has the merit of simplicity, and is regarded by some authorities as possessing a minimum of objectionable features. It destroys combustible matters at such a high temperature that malodorous fumes are not apparent. The two processes are entirely distinct in methods as in results. Reduction aims at, and indeed, depends for its success largely on revenue. In addition it may be argued that incineration at all times involves a bill of expense. Further, owing to the vast increase in the values of grease and tannage, garbage reduction may appear, at first thought, to be a process even more valuable for its revenue possibilities to-day than in normal times. As against this latter argument, however, it is pointed out by civic officials that within the last year or two the appeals for economy have so reduced the proportion of food wastes in the garbage content (the value of the by-products depends almost wholly on the presence of food wastes), as to greatly diminish the value of recoverable by-products. It is difficult, indeed, to forecast to just what extent the citizens' spirit of economy will govern garbage disposal in the future, but it is reasonably possible that the valuable by-products will be smaller in amount for some years to come. There is also the much greater capital expenditure to be considered. De-tinning processes, now so vigorously applied in Great Britain, can scarcely find application on this continent, or at least in Toronto, owing to the high labor costs. As existing de-tinning processes can make use only of sound, unrusty, and un battered tins, and as these must be carefully packed and freighted, the cost of labor for proper sorting and selection is prohibitive.

In an article published in this issue, Toronto's incineration equipment is described. The plant, while not the largest, is without doubt the most up to date on the American continent. Its construction and initial operation have been carefully watched by sister municipalities throughout Canada and the United States. It is now in complete operation, and is

disposing of Toronto's garbage more effectively even than was anticipated. In nearly one half of the city it has abolished the dump, and a second plant is now contemplated to cope with the remaining area.

It is known that Street Commissioner Wilson, under whose jurisdiction the operation of the plant falls, recommended originally a reduction plant which would have taken its place as a revenue producer. Such a plant would have been located in Toronto's new industrial section—Ashbridge's Bay—and would have been inoffensive in every respect. Recently developed processes can, in fact, guarantee results unaccompanied by odors or other disagreeable features. The City Council, however, for various reasons, saw fit to refuse the Commissioner's recommendation. The incinerator was then projected, and, while no revenue can be expected, it accomplishes in a most admirable way the primary purpose aimed at—the disposal of garbage. It accomplishes this, in fact, to a degree beyond the specified guarantee by an excess of 133 per cent in capacity. In other words, the burning capacity is 233 per cent of the guaranteed capacity. This result, developed under official test, is indicative of the superiority of the new installation.

The new equipment is the most modern that the science of incineration has developed. The location of the plant, in relation to the section of the city it serves, is admirably adapted to avoid the congestion of dump wagons either entering or leaving the building. The multiplicity of street approaches and exits prevents any noticeable concentration of garbage-hauling equipment. To the average observer, therefore, there is little to indicate the location or the nature of the building. It is further accentuated by the very noticeable lack of odor or smoke during actual operation.

An especially pleasing departure from the general trend of municipal practice is the housing of the equipment in a building of extremely attractive design. Too many public buildings of this character are so poorly planned as to be an eyesore. The City of Toronto has never been lax in its effort to provide pleasingly-designed buildings. Not only does the new incinerator building itself possess attraction, but its surroundings have been arranged in keeping. In short, an effort has been made to give incineration an air of respectability. It is not a process henceforth to be isolated or tabooed. Those familiar with the present site of the Don district of Toronto, with its mass of railways and industrial plants, will recognize the destructor as truly a star on the horizon.

In the year 1923 specifications and plans were prepared for another destructor, of 400-ton capacity, to replace the Western crematory, and to provide for the disposal of refuse from the west and north sections of the city. In the design and construction of this plant, improvements were incorporated based on the experience of operation and the general layout and performance of the Don destructor during the previous six years of its operation. The Wellington destructor, which is located in the southwestern section of the city, was completed at the end of 1924 and has been in continuous service since. It has a rated capacity of 400 tons per day. The capital cost amounted to \$550,000.

For the next ten years the Don and Wellington destructors served to dispose of from 75 to 80 per cent of the refuse collected, but because of the development in recent years of the north and northwestern sections of the city, these

plants were overtaxed. The length of haul, which in some cases was as high as seven and one-half miles, necessitated the passage of collection vehicles through downtown and other traffic congested thoroughfares, and practically no dumping points for refuse were available within the city limits. Further, the partial or complete failure of the existing plants gave the Department much concern. The Department after considerable effort succeeded in securing authorization to purchase a site, located in the extreme northwest section of the city, on which to erect a third disposal plant. The plant is known as the Symes Road destructor. It has a guaranteed capacity of 500 tons per day, and was erected complete and placed in operation in July 1934, at a capital cost of approximately \$500,000.

The destructor plants owned and operated by the City of Toronto are similar in many respects. They are of British design, and are known as the "Sterling" High Temperature Refuse Destructors. The furnaces are of the continuous grate, regenerative type, four cells to each furnace, the cells being divided by low set air-cooled surrounding castings which render it possible to fire and clean the grates individually. The gases pass from the furnaces into the combustion chambers, which are of such dimensions as to permit a rolling action and complete combustion of the gases; a portion of the gases passes through the air heater tubes, the air heaters being designed for preheating the forced draught; all other gases pass through the main and connecting flues and expansion chambers, and thence into the chimneys. All plants are equipped with electric motor-driven, direct connected, forced draft blowers. At the Don plant the blower capacity is 8000 cu. ft. per second, four inch static resistance, while at the Wellington and Symes Road plants there are 10,000 cu. ft. blowers, four inch resistance. Complete automatic air compressor units, electrically driven, with receivers, provide air for operating the furnace charging hole doors. The furnaces are top fed, the Don and Wellington are manual charged, while the Symes Road is crane fed. The material delivered to all plants is weighed, and at the Don and Wellington it passes on to the tipping floor, and is dumped to the charging floor below, from where it is charged into the containers by the charging men. The stokers regulate the dumping of containers, the material passes through quick opening and closing charging doors, and drops on the drying hearth at the back of the furnace, from where it is drawn over and spread on the grates where incineration is effected. The residue is drawn off the grates through large clinkering doors at the front of the furnace. It passes through openings on the stoking floor, and is dumped into side-dump ash trucks which are operated on a narrow gauge track. The residue is moved along the ash run in these trucks and elevated to the ash storage bin. Its final disposal is by motor truck to the residue dump.

The Symes Road destructor is perhaps the most modern mixed refuse high temperature destructor of recent time, in many respects improvements over the older design having been incorporated. The tipping floor is 50 feet in width, extending the full 124-foot length of the building. Large exit doors at the end facilitate the quick manipulation and dumping of the collection trucks and wagons. The material is dumped into a pit with a capacity of approximately 300 tons, its dimensions being 15 ft. in width by 17 ft. in depth by 124 ft. in length. The plant is equipped with crane feeding equipment which consists of two electric overhead, four-motor, grab bucket cranes of $3\frac{1}{2}$ tons capacity, having a hoisting speed of 150 ft. per minute, each operating a 2 cu. yd. grab

bucket. The cranes are well designed, with all motors and gearing fully enclosed, running in oil, ball or roller bearings throughout. Buckets are of the full opening type, equipped with sheave pulley closing device, six to one purchase, bottom sheave assembly fully enclosed and fitted with cover guard plates.

The layout of furnaces in this plant is a departure from the conventional design. It consists of four furnaces, set up in pairs, back to back, which plan permits a stoking aisle opposite each unit, wider than is usually the case, with four furnaces set in line. This layout has many advantages, inasmuch as crane bridge travel is reduced to a minimum, and the compactness of the charging bins on the top floor renders it possible for one crane to feed three furnaces, when operating at a rate in excess of the guaranteed capacity. Further, the equipment is housed in a shorter building, which reduced building costs, and also made it possible to design the plant for erection on a smaller site, a factor which was important when this plant was designed.

Another important departure from the design of the older equipment is in the air heater layout. The Don and Wellington plants are equipped with up-draft regenerators built in the main flues, designed with cast iron top and bottom tube plates, and steel tubes. Cast iron tubes with a wall thickness of $\frac{5}{16}$ -in. were originally installed in the Don plant but these were replaced some years later by steel tubes. It is understood that the Don plant was the first in American practice where the gases, at final combustion chamber temperature, were passed into an up-draft air heater. This design necessitates constant vigilance in operation of the plant, as the flue damper controlling the flow of gases through the regenerator must be closed when the fans are not operating; otherwise the bottom tube plates would become overheated, and this condition, with the dead load of the tubes, will cause them to sag, and result in a bad air leakage. The air heaters at the Symes Road plant are offset from the flues, and are down-draft in operation, which renders the plant more flexible from an operating viewpoint, as the furnaces may be operated under natural draft without any influence on or risk of damage being done to the regenerator. All parts of the latest plant, including furnaces, flues, heaters, and expansion chambers, are sheeted with steel plate $\frac{3}{16}$ -in. in thickness, with provision made throughout for expansion. This detail gives a uniform exterior with no visible cracks in the brickwork, as are sometimes present in brick settings, although the older plants have withstood their many years of operation without serious objection in this regard.

All plants are equipped with radial brick chimneys, 175 ft. high, each having an octagonal base 25 ft. in height, upon which the radial column of 150 ft. is constructed. The Don plant is equipped with a single chimney. The Wellington and Symes Road installations have twin chimneys. The internal diameter of the firebrick linings is 90 in. for the Don and Wellington destructors, while the Symes Road plant chimneys have 120 in. inside diameter. All chimneys are lined from the foundation to the top, with self supporting fire brick linings braced with a steel corset, devised some years ago by the Department at the Don and Symes Road plants. The linings at the Wellington were almost completed at the time this corset was designed. The steel corset braces the linings from the base to top, with adequate provision made for support at the flue openings. This type of construction for a high temperature destructor chimney, self supporting fire brick linings, when properly designed

and installed in conjunction with suitable firebrick will guarantee minimum future defects. The lining at the Don destructor, which was originally equipped with self supporting lining constructed with pilasters, collapsed after six years of operation, and was rebuilt by the Department and equipped with a steel corset in the year 1923. Since that date, during which it has been in continuous operation, no repairs to the lining have been made and it is at present in a good state of preservation.

The maintenance cost of destructor plants, when consideration is given to the nature of work they are called upon to perform, has been noted to be quite low, when comparison is made with those of similar installations. In the design and construction of the plants careful consideration has been given to cope with the many undesirable features accompanying the operation of destroying the various classes of waste delivered, such as extreme varying temperatures, presence of steam, high volatile and combustible material and other conditions not present in practice where a uniform fuel is being consumed. At all points where stresses occur, adequate steel supports have been provided. The plants throughout are supported by strong and substantial buck-stays, securely braced; all arches are provided with suitable steel skew-back supports, the continuity of arches in series broken by individual supports. Materials have been carefully selected which are best suited for the work intended. Considerable study and experiment has been given to the best suited refractory material which forms the major part of these installations. Special shapes have been eliminated in design as far as possible and, further, the laying up of the various materials has always been well executed and thoroughly supervised.

Time will not permit any comprehensive statistics as to the cost of operation, tonnage of material consumed, furnace, or man hours of labour, etc. These particulars are contained in the official report of the Street Commissioner for 1935, a copy of which may be procured from Mr. H. D. Bradley's office by any party interested. Suffice it to say that with the construction of each plant a marked improvement has been effected with respect to cost of operation and tonnage consumed. The plants dispose of mixed refuse, in the approximate proportion of 65 per cent garbage, and 35 per cent rubbish by weight, under normal operating conditions at a rate in excess of their guaranteed capacity. However, in recent years, due chiefly to unemployment conditions, considerable combustible rubbish ordinarily collected by the Department has been picked up by other collectors and sold, a condition which obviously influences the calorific value of the material. During the heavy fruit and vegetable season the Department has to curb this practice; otherwise supplementary fuel would have to be mixed with the refuse. Under ordinary conditions, however, all plants are operated without the use of additional fuel to furnish heat. The reduction of material amounts to approximately 89 per cent with 11 per cent incombustible, innocuous residue.

By-laws dating back to 1915 have been enforced governing the manner in which citizens shall place the material for collections, separating mixed garbage (strained and wrapped), and rubbish in metal covered receptacles from ashes and incombustible waste. The citizens generally have cooperated admirably with the Department's requirements in this regard.

The construction, maintenance, and operation of the destructor plants comes directly under the Street Commissioner, who has an engineer in charge responsible to him for the general performance of this and all mechanical equip-

ment of the Department. Each plant has a foreman responsible for the control of the staff and operation of the plant under his jurisdiction. The plants are operated on a two-shift eight-hour day basis, five and one half days each week, from 7:00 A.M. to midnight for five days, 7:00 A.M. to 3:00 P.M. on Saturdays, shut down on Sundays and all public holidays. The successful operation of the plants reflects great credit on the operating staffs, as the results attained during the many years of operation is due in no small measure to their cooperation and efforts. All maintenance and repair work, including inspection of new construction, is directed by the Department.

Mention is made of the type and design of destructor plant in use by the City of Toronto. The Don destructor equipment was furnished and erected by the Canadian Griscorn Russell Co. The Wellington and Symes Road destructors were constructed and guaranteed by the Francis Hankin Co. of Montreal and Toronto, licensees of the C. O. Bartlett and Snow Co. of Cleveland, Ohio, who are the licensed representatives of the New Destructor Co. of Pershore, England, for Canada and the United States. The preparation of specifications, and all engineering for the destructor disposal plants have been executed by the Department of Street Cleaning of which Mr. H. D. Bradley is Street Commissioner. The design, construction, and supervision of all buildings which house the destructor equipment have been carried out by the City Architect's Department, of which Mr. K. S. Gillies is the City Architect. All buildings are of fireproof construction throughout.

The high temperature mixed refuse destructor, for the rapid, sanitary, and economical disposal of municipal combustible waste, is comparatively new on this continent. Previous to the erection of the Don destructor less than twenty years ago, very few cities were disposing of their waste by the process of high temperature incineration. Today many cities both in Canada and the United States are operating plants under this system; and the process is established as a satisfactory method of solving the refuse disposal problem.

GRINDING AS A PROCESS IN GARBAGE DISPOSAL

MARK B. OWEN

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GRINDING as a preliminary step in the disposal of garbage appears to be the first innovation in this branch of municipal service in many years. The development of a grinding unit for use under the kitchen sink is the first device of this type offered for the convenience and comfort of the housewife.

As a means of reducing municipal collection and disposal costs, the application of the grinding principle appears to present a method that may some day become the common and accepted process. Before that time arrives, however, many problems involving sewage treatment processes must be solved.

The grinding plan of disposal may be applied in three ways, namely: by installation of the home grinder, by construction of centrally located grinding stations, or by grinding at the sewage plant.

To a certain degree, the success of all three plans depends on the ability of sewage treatment processes to handle the additional load of garbage solids. The first two ideas presuppose that no trouble will arise from the use of house plumbing systems and city sewers in passing and conveying ground garbage. In many of our present sewage treatment plants, particularly those having sludge incinerators, the addition of properly ground garbage in certain parts of the process would cause no difficulty whatever.

HOME OR KITCHEN GRINDERS

After several years of development work and testing, the General Electric Company has placed on the market a machine called the Disposall. This equipment is designed to fit most of the modern kitchen sinks, and operation is based on preparing the garbage in such a manner that it can be discharged through the existing house plumbing system without trouble.

Morris M. Cohn, Sanitary Engineer of the City of Schenectady, who has done much original work investigating this machine and process, describes the device as follows:

The device consists of a waste-receiving compartment, a grinding compartment and a motor, all in one assembly. It is installed under and directly attached to the sink drain opening. The usual perforated plate in the sink bottom is replaced by a large clear opening of the size of the duo-strainer sink opening, which is closed by a removable perforated plate.

This opening leads directly into the waste hopper, where the food wastes are accumulated prior to grinding. The compartment has a capacity of one quart and holds approximately one pound of wastes. It is perforated to permit the free flow of water into the drain, just as does the regular sink.

Under the storage hopper is located the grinding compartment into which the wastes are dropped by the operation of a handle which overturns the hopper. Rotating shredders and the swirling water throw the wastes against a set of file-like shredders that reduce the wastes to a fine pulp. Pulp and water enter a compartment shaped like the scroll and discharge end of a centrifugal pump that discharges the wastes

through a regulation plumbing trap into the usual drain line, and thence to the sewer.

Normal food wastes may be disposed of at a rate of one pound per minute, with a water consumption of $2\frac{1}{2}$ g.p.m. Mr. Cohn's investigations showed that "grease was converted into an air-whipped non-greasy form which did not coat piping." He further reported that "house sewers and public sewers showed no evidence of solids shoaling or grease formations," and that the condition of house plumbing after many test installations indicated "that the pressure discharge of the water-borne wastes gave the lines a mechanical scouring."

Within the last thirty days the writer visited the Dearborn West Side Sewage Plant and observed on the coarse screens the following items of waste food: quarters of cantaloupes, halves and skins of oranges and lemons, portions and slices of tomatoes, fish heads, potato peelings, egg shells, meat scraps, coffee grounds and other similar wastes. This condition appears to be common in a great many plants, and also seems to be growing steadily. In the writer's opinion, this practice has more than doubled in the last five years. In view of this situation the fear that kitchen wastes grinders may cause trouble in the house plumbing seems to be needless, especially so because of the fineness with which the device grinds the materials.

At the present price of installing this device, only a very small percentage of the homes will be enjoying this convenience. For some time, perhaps, home grinders may not cause any difficulty, if at all, in either the matter of house plumbing, or effect at the sewage works. Present installations will undoubtedly be confined to the higher priced houses whose plumbing systems should be entirely adequate for the purpose, if not actually designed for it. The Disposal may, however, enjoy a history like that of electric refrigerators. In that case we shall see a great majority of home owners acquiring and using them. We may even witness their universal use in apartment houses before that time. It is the belief of the writer that garbage grinding in the home is with us to stay, and that its use will become more common. Sewage plant operators are going to have this additional load to handle some day, and should make plans now to provide for it.

CENTRAL GRINDING STATIONS

Without considering the effect of ground garbage on the sewage plant, central grinding stations offer the most economical method of garbage disposal in a sanitary manner. They may be located throughout the city in such a way that very great savings can be made in garbage hauling. The reduced length of haul per vehicle will result in more frequent collection service per house.

The simplicity of design, construction, and operation of central stations, together with the relatively low capital investment, makes this method very attractive. When costs of any additional sewage plant structures that may be necessary because of the additional solids loads are considered, this method may still offer the most economical plan of disposal.

Any site chosen for a central station should conform to the following requirements: central location, with respect to the population; close to a large sewer carrying sufficient water, at a high enough velocity, to properly dilute and convey the ground garbage; a reasonably large site so that noise and odors will be isolated.

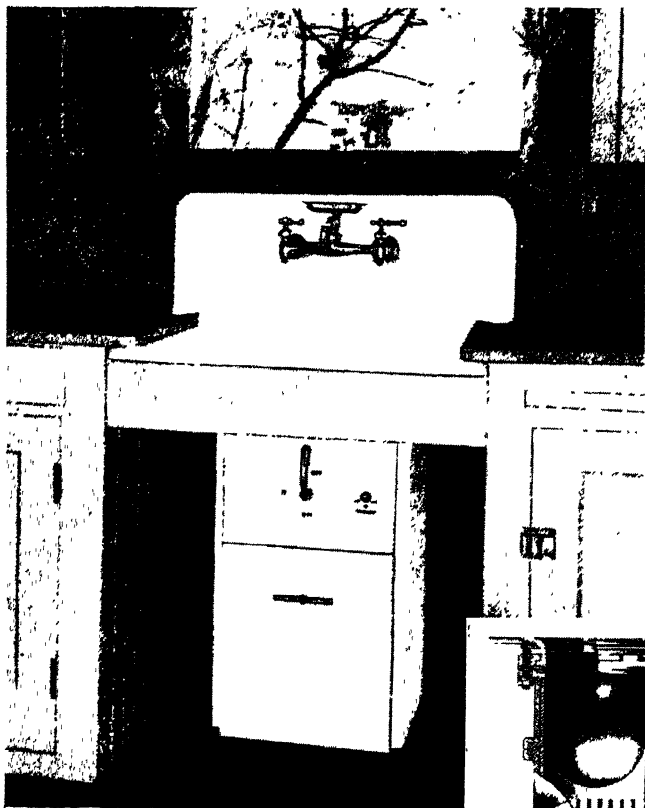


FIGURE 1

Home or kitchen grinder, installed beneath
a domestic sink

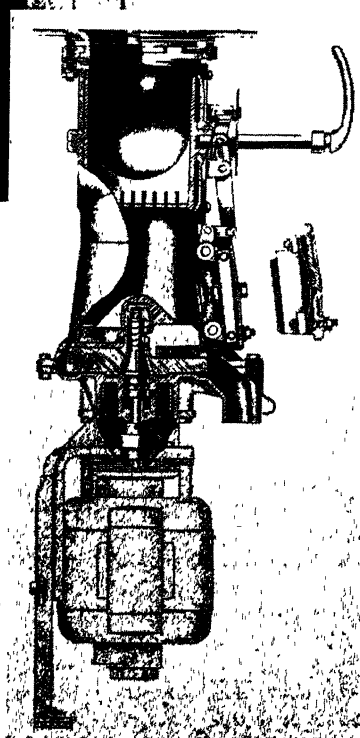


FIGURE 2

Section view of home or kitchen grinder

In most communities, the first two requirements will not be difficult to comply with. The problem of noise and odors can be more or less controlled by the use of the proper sound absorbing materials in the structure and the judicious use of deodorants about the station.

The essential requirements of the station itself are adequate area for garbage discharge from trucks; area for sorting or picking garbage; space for grinding equipment.

Two general types of machines are available for garbage grinding—the swing hammer mill kind, and the rotary shear type.

The hammer mill machine consists of a number of hammers, or knives, attached to a very heavy shaft that is mounted in a cast-iron box, or case. The side of the case towards which the hammers rotate is formed by a hardened steel striker plate, hinged at the top so that the space between the ends of the hammers and the plate may be varied. This spacing is normally about $\frac{1}{4}$ in. The bottom of the case is formed by a semi-circular screen of heavy steel bars. About $\frac{1}{4}$ -in. clearance is maintained between the ends of hammers and the bar screen. Bar screens of various widths of clear openings may be obtained for producing a ground material ranging from coarse to fine. The degree of fineness of ground material may also be controlled by changing the speed of the grinder—reduction of speed producing a coarser material.

For catching pieces of heavy scrap metal that may enter the machine, a metal trap is provided on the side of the grinder. The fast moving hammers kick this foreign material into the trap automatically. Tin cans and bottles, however, are not in this classification: they pass through the machine without trouble.

Garbage is fed into the machine through a trap door, and in falling is struck by the rapidly revolving hammers which drive the material down through the space between the hammers and the striker plate and force it out through the bar screen at the bottom.

Grinders of this type, as made by the Jeffrey Manufacturing Co. are available in sizes from 6 to 60 tons per hour, based on fine grinding. The motor requirements for these machines vary from 25 to 200 h.p., also based on fine grinding. The manufacturer states that coarse grinding of the same quantities takes less horsepower.

Of the rotary shear type, only that manufactured by Mitts & Merrill is familiar to the writer. According to the data sheet of that company, the Mitts & Merrill Hog was designed for grinding into a fine and uniform product carcasses, bones, viscera, garbage and similar materials.

This hog consists of four $1\frac{1}{4} \times 6$ -in. heavy shear blades, offset on a full cylinder that is mounted on, or is a part of, a heavy shaft. The assembly is mounted in a heavy cast iron case. Located in the frame of the machine are four stationary shear blades, against which the moving blades give a shearing cut throughout their entire length. The action of the blades is similar to that of the alligator shear used for cutting scrap metal. In operation, the material is cut and recut a number of times before being discharged.

To provide against tramp metal injuring the machine, a safety device, consisting of a series of swinging doors, is located in the feed spout of the hog. These swing doors are held in place by cast iron struts which break when any piece of tramp metal is forced against the doors by the shears, and allow the door to open, discharging the metal. The machine is easily put back in service by replacing the safety strut.

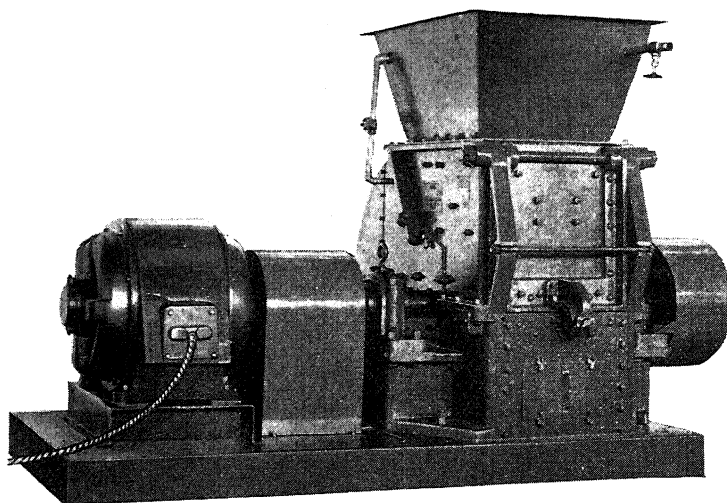


FIGURE 3
Swing Hammer Mill Garbage Grinder

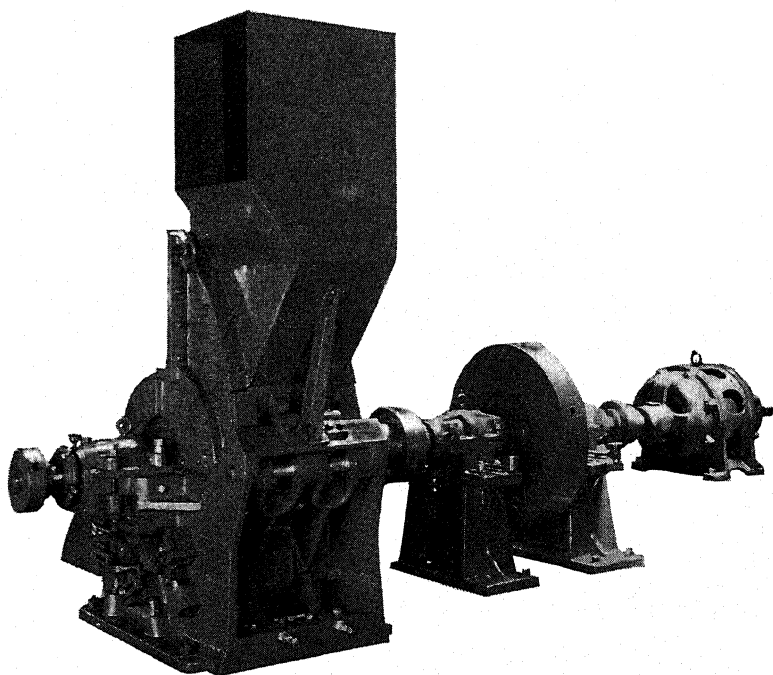


FIGURE 4
Rotary Shear Garbage Grinder

According to the manufacturer, these hogs "can be adjusted so as to grind material to almost any degree of fineness. The adjustment is made in the knives and throat bars." As in the case of the hammer mill type, this machine will produce coarser material with less power, or more coarse material with the same power.

Hogs are available in sizes ranging from 6 to 24 tons per hour, based on very fine grinding. Motor sizes specified range from 40 to 150 h.p.

GARBAGE GRINDING AT BALTIMORE

According to the literature on the subject of garbage grinding, the first attempt to grind garbage, discharge it into the sewers, and dispose of it at a sewage plant was made at Lebanon, Pennsylvania, in 1923.^{1*} No data seem to be available on this work; nor does the writer know why it was abandoned. According to Cohn⁷ this method is again being advocated in that city.

The next use of this idea was made by C. E. Keefer, in Baltimore, during 1933.^{3†} There, the plant was designed and built to relieve the municipal incinerators of the peak loads occurring during the summer months.

The building enclosing the grinding station was a three-sided wooden shed, 24 x 26 ft. in plan. The ground floor, which was concrete, pitched to a 2 x 3 ft. 9-in. opening directly over the feed hopper of the grinder, located in a pit below. The grinder was of the hammer mill type, rated at 20 tons per hour, and driven by a 1,140 r.p.m. by an 100-h.p. motor. Spray nozzles were provided in the grinder to flush the material through the machine and into the sewer system.

Garbage, dumped from vehicles onto the floor, was manually fed into the hopper of the grinder. During this operation, metal and other materials foreign to garbage, were removed. Disposal by this method proceeded for 24 days, during which time a total of 1,693 tons of garbage, or an average of 70 tons a day, were ground and discharged through a 24-in. vitrified sewer into the city sewer system. From four to six men were used to feed the grinder. The power consumption averaged 4.35 kw-hr. per ton of garbage.

No difficulty was experienced with the grinding operation, except when large quantities of corn husks were fed into the machine. Keefer reported that this material slowed up grinding and that the husks passed through the grinder as long fibers and were caught on the coarse screens at the sewage plant. What the spacing of the grinder bar screen was at that time was not stated. Apparently, screens having spacings of from $\frac{3}{4}$ to $1\frac{1}{2}$ in. were used at various times.

To determine the effect of this additional load of solids on the sewage treatment process careful observations were made, and numerous samples of sewage were collected and analyzed. A considerable increase in grease and scum, the

* Superior figures refer to items in the bibliography, pp. 13-14.

† It is interesting to know that, seven years ago, Samuel A. Greeley and L. B. Turner, in a short paper entitled "Notes on Recent Items of Interest Relating to Garbage Disposal,"²⁸ made some prophetic remarks on this subject. They commented on the work that had been done at Lebanon, Pa., and mentioned the possibility of garbage disposal by digestion with sludge. This was five years after the Lebanon experiment and four years before the Baltimore test.

About the year 1901, M. N. Baker²⁸ remarked that in no branch of municipal service had so little progress been made as in that of garbage disposal. That remark could have been repeated thirty years later—so slowly have we progressed.

latter containing ground garbage, was noted in the preliminary tanks. A 50 per cent increase of screenings, mostly fibrous material from corn husks, was reported captured by the $\frac{7}{8}$ -in. opening sewage screens.

Suspended solids and settling solids, during the grinding period, averaged 271 p.p.m. and 205 p.p.m., as compared with a five-year average of 234 p.p.m. and 167 p.p.m. for the same time of the year. Although the 5-day B.O.D. showed only a slight increase, Keefer observes that "garbage solids are generally far from being in the same putrefied condition as sewage solids," and that a 40- or 50-day incubation period might be necessary to show the true increase in oxygen demand.

Keefer suggests that because of noise and odor, plants should not be built near dwellings. The noise, he says, can be heard 400 or 500 feet away. He concludes that compared to either incineration or reduction, "the odor nuisance should be much less."

THE ST. LOUIS GARBAGE GRINDING STATION

The first municipal garbage grinding plant for the disposal of all garbage collected by city forces was built by St. Louis, Missouri. After considerable experimental work, this plant and disposal method was designed and built in 1934, by city personnel, under the direction of Frank J. McDevitt, Director of Streets and Sewers, of St. Louis. It was placed in regular operation during the month of February 1935, and has been in continuous service ever since that time.

Because of local ordinances, past customs, and conditions, all of the city's garbage is not collected by city forces. There are many city-licensed scavengers and, according to reports, many unlicensed "bootleg" scavengers, that also collect garbage. An accurate record of the city's garbage production is, therefore, not available. According to Mr. McDevitt's 1934-35 Departmental Report, the garbage collected by the city during that period was approximately 50,000 tons. At present, the average annual quantity collected and disposed of is 40,000 tons.

All city-collected garbage is hauled to the grinding station, located in the geographical center of the city, at Forest Park Boulevard and Vandeventer Avenue. The plant building is constructed of steel and brick, with a sheet steel roof. The structure is 51 x 63 ft. and 15 ft. high to the eaves. It contains two complete disposal units, one being a stand-by unit for emergency use.

Green garbage is dumped from trucks directly into a rectangular concrete pit, 23 x 10 ft. in area, with 8-ft. vertical walls and steeply-sloped bottom. The discharge from this pit is through a long slot at the bottom, directly over a pan-type steel conveyor.

The conveyor, which may be operated at various speeds, travels under the pit and upward to a point between the pit and grinder, and then along a horizontal section, about 4 ft. above the working floor, to the feed hopper of the grinder. The grinder is a 20-ton hammer mill type, driven by a 125-h.p. electric motor, and equipped with screen bars with 1-inch spacing. A fairly uniform feed is maintained to the grinder by virtue of the various controllable speeds of the conveyor. Immediately after a load of garbage is dumped in the pit it is pressure sprayed with an inexpensive deodorant.

On either side of the horizontal section of the conveyor (above floor level) are stationed two laborers, equipped with rubber gloves and a hoe-like fork.

Their duty is to pick out cans, bottles and other materials foreign to garbage.

Ground garbage is discharged into the sewers, and eventually reaches the Mississippi River. The sewer connecting the plant with one of the trunks carries practically nothing but ground garbage. For this reason the St. Louis station is compelled to use enough water in the grinding operation to produce a flow in the sewer of from 400 to 500 g.p.m. of garbage liquor.

Mr. McDewitt states²² that the plant, with stand-by unit, cost about \$40,000, and that it costs about 50c per ton of garbage for disposal. In his Annual Report it is stated that "daily inspections in the sewers adjacent to the plant do not show any deposits. The discharge from the grinder, resembling thick soup, becomes digested* after mingling with the sewage for a few city blocks and at the sewer outlet into the Mississippi River about two miles away no vestige of garbage is discernible." The report also states: "It should be emphasized that there are no obnoxious odors emanating from the grinding plant."

The writer recently visited this plant when atmospheric conditions were ideal for odor production. It was about noon, with a hot August sun beating down on the rather low steel roof. The official temperature was 104 deg. F. outside. Inside the building there was the usual fresh garbage odor, but nowhere near as intense as one would expect. It would not have been termed obnoxious. The use of a deodorant and the fact that the garbage is constantly on the move probably account for this condition.

Although the building has large wall-openings on three sides, there was no plainly noticeable odor 150 feet away. The plant is surrounded by industrial buildings, and apparently has not been a nuisance or proved objectionable to the owners of adjacent property.

Before the War Department gave the city of St. Louis permission to dispose of ground garbage in the river the United States Bureau of Fisheries investigated the condition of the river below the city. While it has been stated there is no apparent change in the condition of the river water since this dumping has been started, a statement recently made by a member of the Fisheries Bureau is quite enlightening. Dr. M. M. Ellis, who was in charge of Interior Fisheries Investigations for the Bureau, appeared before the Dern-Loneragan Conference on Stream Pollution and Stream Purification, and said:²⁴

It has been necessary, therefore, as far as fisheries interests are concerned, to classify the pollutants along other lines than those which are of large importance in public health or in other economic contacts. First, we may consider those pollutants which create a definite oxygen demand and we have many types of organic material which, when placed in the stream, use the available dissolved oxygen so that the fish find themselves in an environment containing little or no oxygen for their respiratory needs. Too much stress must not be placed on the laboratory determinations of oxygen demand of any particular polluting substances. This was brought out strikingly in a survey of the pollution situation near St. Louis recently with reference to proposed changes in garbage disposal method. We mapped the Mississippi River carefully from St. Louis to Cairo and members of our staff made simultaneous determinations at the various points along the river. These determinations included among other things dissolved oxygen.

The oxygen demand created by the sewage of the St. Louis area is severe, but

* The word "digested" as used here probably refers to, or describes, the completeness of assimilation.

as the river rolls over near Jefferson Barracks new factors come into the complex, and if you sample the water a short distance below Jefferson Barracks you will find that the oxygen demand created by the organic wastes of the St. Louis area has apparently been satisfied. This, however, is a spurious finding. If you go farther downstream you will find that the conditions producing this rise in dissolved oxygen drop out and the same organic waste which was placed in the river at St. Louis and which has not been completely disposed of, is still damaging to a large extent even at Cairo, Illinois, over 100 miles downstream. The oxygen demand of the sewage wastes from St. Louis is such that even at Cairo the Mississippi River water still contains so much organic material that within 15 miles below the junction of the Ohio River with the Mississippi, the Mississippi River has taken all of the donations of the dissolved oxygen brought in by the Ohio River and is receptive for more.

THE INDIANAPOLIS STATION

On May 1, 1935, an explosion occurred in the Indianapolis Garbage Reduction Plant that put it completely out of service for seven months. In order to cope with the immediate problem of garbage disposal, C. K. Calvert^{12 and 20} set up a grinding plant at the grit chambers of the sewerage system.

Because of the emergency, the plant had to be hastily constructed. It consisted of a wood-lined pit of about 40 tons capacity, for receiving garbage; an elevated charging or grinder-feed platform; a small centrifugal pump for supplying flushing water; a clam-shell bucket-equipped crane, for handling garbage and grits; a hammer mill grinder, rated at 10 tons per hour, and driven by a 50-h.p. motor. No enclosing plant structure was built.

During the seven-months' shut-down of the Reduction Plant all the Indianapolis garbage, totaling 17,256 tons, was hauled to this grinding station. Collection vehicles discharged their loads directly into the pit. From there the garbage was transferred, by the clam-shell, to the charging platform, where three men fed it into the hopper of the grinder. When the grinding operation started, the machine was equipped with bar screens of $\frac{3}{4}$ -in. spacings. In the fall, the spacing was reduced to $\frac{1}{2}$ -in., then $\frac{3}{8}$ -in., and finally to $\frac{1}{4}$ -in.

The effect on the sewage treatment process was quite interesting, and in order that the results may be better understood a brief description of the process is given here.

All the sewage passes through channels to fine rotary screens. About two thirds passes through the screens, and one third, together with rejected solids, passes directly to rapid settlers that provide about 20 minutes' detention. The supernatant from the settlers joins the sewage that has passed through the screens and becomes the so-called clarified sewage that goes to the aeration tanks. Solids from the rapid settlers and sludge from the aeration process is pumped to lagoons for digestion and final disposal.

Because the plant is too small to treat all sewage by the conventional activated sludge process, plain aeration is given all sewage, without returned sludge. For purposes of study, however, one aeration unit is operated as an activated sludge plant. During the garbage grinding period, sewage was treated by three methods—plain settling, plain aeration, and activated sludge.

Throughout the grinding period, sewage samples were carefully collected and analyzed. The effect on the sewage treatment process is indicated by the data as presented in Mr. Calvert's paper²⁰ referred to above, and reproduced, through his courtesy, below.

PLAIN AERATION PLANT

Period	Cu. Ft. of Air Per Gal. of Sewage	B.O.D. in p.p.m.			Thousands of Pounds B.O.D. Removed Per Million Cu. Ft. Air
		To Aeration Tanks	From Aeration Tanks	Removed by Process	
June-Dec. 1934	0.62	228	106	122	1.77
Jan.-May 1935	0.48	196	87	109	1.89
June-Dec. 1935*	0.51	231	107	124	2.08

ACTIVATED SLUDGE PLANT

June-Dec. 1934	1.23	228	27	201	1.34
Jan.-May 1935	1.09	196	19	177	1.31
June-Dec. 1935*	1.25	231	28	203	1.34

The disposal costs by grinding for the seven-months' period (excluding interest and depreciation, and with no supervision other than that of a foreman) are given by Calvert,²⁰ as follows:

Item	Total	Per Ton
Supplies	\$ 33.97	\$0.002
Power	1087.36	.063
Labor	4077.98	.236
TOTAL	\$5199.31	\$0.301

It seems evident from the data presented that the addition of garbage to the sewage in Indianapolis had no ill effect on the treatment process. In speaking of the activated sludge process, Calvert said that the data "do not indicate that the process was improved by the addition of garbage, but there is also no indication that the garbage caused disruption of the activated sludge process." He concludes that "sludge production was a little higher, perhaps, than usual, but was almost normal."

GRINDING STATIONS AT SEWAGE PLANTS

In communities where the collection area is not too large to make the garbage haul prohibitive, locating the grinder at the sewage plant has some desirable advantages. Because of the general isolation of sewage treatment works, the objections raised regarding noises and odors are practically eliminated.

Garbage ground at the sewage plant may be discharged into the sewage ahead of the grit chambers, or ahead of the clarifiers; or, mixed with sludge and pumped to the digesters. Discharge ahead of grit chambers and screens will necessitate more frequent attention to these units.

In Indianapolis, Calvert calculated that after removal of bones, bottles, and metal, the total grit from green garbage weighed 38.2 lb. per ton of garbage, and represented about 23 per cent of the total grit for a maximum year. During the grinding period, the grit produced was very offensive because of the higher organic content, and was removed every week and buried.

The effect on the quantities of material captured by the sewage plant screens is indicated by Keefer's experience during the season when corn husks form

* Garbage grinding period.

a large part of the garbage. He reported that screenings increased 50 per cent, most of which was plainly ground garbage in the form of long fibers of corn husks. Ground garbage also formed the bulk of the additional scum noted on the settling tanks.

Carpenter,² Cohn²³ and Keefer,^{2,3 and 17} as a result of their experimental work and investigations, agree that the sewage-garbage mixture settles as readily as sewage alone. They also state that the effluent from this settled mixture contains more finely divided floating material, and contains a higher B.O.D.

The digestion of garbage solids with sewage solids has been tested experimentally, and in fairly large tests, by Bloodgood,¹⁸ Keefer and Kratz,^{2 and 4} Babbitt,¹⁰ Fair,⁵ and Carpenter, Rogel and Grabois.²¹ Keefer determined that equal parts of volatile solids of garbage and sewage, totaling 5 per cent of the digesting solids, under temperature controlled conditions, digested readily, and without difficulty.

The relative quantities of garbage and sewage solids produced in a city may be such that digesters will never be able to take the entire garbage load. Babbitt states:⁸ "It might develop, therefore, that the digestion of garbage solids in sewage treatment plants would care for only a part of the garbage load; or might be practical merely to diminish the size of the garbage incinerator; or to take care of the peak load of the final method of garbage disposal." He continues: "The glowing possibilities for caring for all the garbage of a city in the sewage treatment plant begin to dim somewhat, but the hope is not entirely extinguished."

While that last statement refers to total disposal by digestion, the hope that all garbage can be disposed of at the sewage plant need not be dim. In plants equipped with modern sludge incinerators, the problem of the combined disposal of garbage and sludge may be simply and economically solved.

The increased quantities of grit and screenings need not create a nuisance, even though the organic content is materially increased. Frequent or continuous disposal of these materials can be made in the incinerator. If part of the garbage is to be digested, the balance may be burned with digested or undigested sludge.

A much simpler plan of combined disposal is available, utilizing incineration. Ground garbage may be discharged into a sludge mixing tank, prior to dewatering by vacuum filters; or it may be discharged directly into the incinerator with dewatered sludge. Nine sewage plants in the United States (one built and eight under contract or construction) are or will be equipped to take advantage of this plan. Four of these plants were specifically designed to dispose of sludge and shredded garbage by incineration.

The sewage works at both Kokomo and LaPorte, Indiana, designed by Russell B. Moore, consulting engineer, of Indianapolis, will be provided with Nichols Herreshoff furnaces for garbage and sludge incineration. The Kokomo plant is designed to dispose of 6 wet tons of digested sludge and 7 wet tons of shredded garbage in 17 hours, or the equivalent of 18.4 tons in 24 hours. At LaPorte, the incinerator is expected to handle 3.64 wet tons of digested sludge and 10 wet tons of shredded garbage per day of 24 hours.

At Colorado Springs, Colorado, Mr. Burton Lowther, consulting engineer, specified incinerator capacity capable of burning 16 wet tons of digested sludge and 6 wet tons of shredded garbage per day of 24 hours. In these three cities, grinding equipment will be installed at a later date, because of financing problems.

Immediate installation of garbage grinding and conveying equipment, as a part of the new sewage plant, is contemplated by Greeley & Hansen, consulting engineers for Kaukauna, Wisconsin. During ten months of the year it is anticipated that 8.33 wet tons of undigested sludge and ground garbage will be incinerated during 6 hours per day. During two months of the year, 33.33 wet tons of chemically precipitated sludge and ground garbage will be incinerated in 22 hours per day. Attached to the main plant building will be a one-story wing about 13 x 16 ft. in plan. Garbage will be delivered to this room and dumped on the charging floor. A grinder located under the floor will be charged manually. Ground material will be discharged into a chute that ends at the boot of a bucket elevator. The elevator, enclosed in a watertight case, will deliver the ground garbage to a horizontal spiral conveyor, so arranged that all or part of the material can be discharged into the incinerator; or all or part can be delivered to a sludge sump. In the latter case the mixture will be dewatered on a vacuum filter, and the resulting cake delivered to the furnace.

Grinder and conveying equipment is designed to handle 500 lb. of material per hour. The grinder is a 20 x 12-in. Jeffrey hammer mill. The incinerator is a 14-ft. 3-in. outside diameter, four-hearth Nichols Herreshoff furnace.

CONCLUSION

While the present price of home grinders is rather high, it is not too much to expect that they will some day be available at a price easily within the reach and purse of the average homeowner. When that time arrives they will be almost as commonly used as electric refrigerators are today.

Central grinding stations appear to offer cities an opportunity to materially reduce collection and disposal costs; or provide more frequent and efficient service; or a combination of both.

The work already done indicates to the writer that where cities have sewage plants equipped with modern sludge incinerators, no hesitancy need be shown in adopting this method of disposal.

In cities of average size, grinding the garbage at the sewage plant and burning it with sewage sludge offers the most economical plan for getting rid of two offensive municipal wastes in a modern and sanitary way.

When the convenience of grinding as a method of disposal is fully realized and appreciated, the objections that may be raised by the sewage plant operator will be overridden. The question "Can he take it?" will become a statement of "He'll have to take it."

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DISCUSSION

MR. MARTIN (Montclair, N. J.): Can you give me the approximate installation cost of that kitchen unit?

MR. OWEN: One hundred and fifty dollars, but that takes care only of food stuffs.

MR. S. SHUPE (Kitchener, Ont.): There seems to be some confusion in the disposal of the material in a wet state. It seems to me that is a rather indirect method—to put it back into water. After having gathered it in a dry state it should be disposed of in a dry state. Of course, that is different for the household unit.

MR. OWEN: I think the answer to that, of course, is one of economics, taking into consideration the cost of collection and the cost of disposal, and how much it is going to add to your sewage plant by way of additional structure. I think those things will have to be considered before anybody can say that that is the cheapest or most economical way to dispose of it in any city.

MR. D. W. GODAT (New Orleans, La.): Won't there be considerable grease coming into your sewer system from the household unit?

MR. OWEN: The experience has been that the action of the grinder itself seems to overcome any objection or bad effect you might have from the grease or garbage. It whips it into a condition that does not seem to stick to the pipes and it goes out through the house plumbing without any difficulty. The sixteen- or seventeen-inch installation made experimentally by General Electric was watched fairly closely and, according to the summary report made after these machines had been operated for a considerable length of time, there was no difficulty at all from the grease in the house plumbing system.

MR. GODAT: Has this ever been tried on a community scale by any system?

MR. OWEN: No, I don't think there has been any concerted effort in any one community.

MR. RICH (Lansing, Michigan): I have one of those machines in my house and have had it since January 1935, and so far as we are concerned it grinds the stuff all right with no grease at all. After the machine had been in use a while I disconnected the outlet pipe and ground a certain amount of garbage of approximately two days' production and caught it in a pail. The ground material is very much in the form of a froth on the top of the water in the pail and it passes right through without any accumulation. However, some attention should be given to the adjustment of the cutting portion of the machine and I have been told this morning there has been an improvement which has reduced the difficulty of clogging. We had clogging with pea pods and it was evidently because the pods were not chewed up in fine enough particles, but since then we have been rather fearful of using it for pea pods. At least my wife will not put pea pods in any more, but they will go through all right now.

The corn husks require cutting. If you put them into the container in full size they will be torn into shreds and twisted in a ball and stay in the cutting

compartment, but if you cut them in lengths of a few inches they will go through all right. Cobs go through without any difficulty, but you have to break them to get them in because they are too long. Some dog dragged a bone into my yard which was old and dried, weighed a pound, and was four inches in circumference. I put it into the grinder for a few minutes and then I looked at it and there were a few scratches on it. However, it does grind chicken bones but there is a little noise.

One of our steel forks got into it but it did not grind that very well. When I looked at it the fork was twisted around the cutter and we had a little difficulty getting it out. It is easy to let those things slip in if you do not watch very carefully because the opening is about four inches in diameter.

I think it should be remembered in connection with this method of garbage disposal that it does not dispose of anything but it puts it into the sewer to be disposed of. It is rather expensive if you figure the interest on the investment and depreciation, but I don't know that that is a fatal objection. In these days we are willing to pay for methods of living that will be more of a convenience. Most everybody has a washing machine now, but we still can make a wash tub out of a barrel, get a dime washboard and wash our clothes, but people do not want to do that any more. They will buy an electric washing machine so they can have that convenience, and they are willing to pay for it. So, I think, the household disposal unit has a field in the light of that idea, but whether or not it will become a universal necessity in the city is a question. However, I do think it will be extensively used in time, and when that time comes the cost of the machine will be considerably lowered on account of the mass production.

All I can say is that we like it and hate to see it taken away. My machine was put in as a demonstration unit and the inspectors have been there two or three times to see how it is working and its condition, and they have found no deterioration of the machine itself, and the knives were not even dull.

MR. M. COHN: I think we are greatly indebted to Mr. Owen for this very splendid survey which he has made. Sometimes an inventory of past progress, with an informal prediction or prophecy for the future is valuable to us, especially if it comes from a recognized authority and, because of that fact, I believe Mr. Owen has made a remarkable contribution to this important subject. Frankly, gentlemen, I know of no phase of sanitary engineering development that has intrigued as many engineering minds recently as this combined disposal idea has. Development has been so rapid that it is almost impossible to keep abreast of the things that are going on.

For example, research work is now going on in such important points as the University of Illinois, New York University, Cornell University, the New Jersey Agricultural Experiment Station, the Lawrence Experiment Station. You see it begins to mount up. There must be something important in such a process to make so many of our recognized national research agencies investigate the matter.

So far as the actual home disposal process is concerned, I have considerable interest in it and I feel somewhat as though I have been the father of the idea, which may have been prematurely born, but nevertheless it does mark a splendid forward step in home sanitation. This experiment is mighty intriguing to municipal officials who are charged with the responsibility of public service.

Our main function in life as I see it is to try to improve the convenience, comfort, and health of the community which we serve. Now, if this method of instantaneous garbage disposal, or disposal into a sewer for ultimate further disposal by some other means, is going to be of benefit either directly or indirectly to public health and comfort, I think the engineer must give it very serious consideration.

It is gratifying to me that that attitude has been assumed and that so much development has gone forward. There has been one question raised here with regard to the municipal acceptance of the process and I think the gentleman from New Orleans raised the question about universal use in any municipality. That has not come nor do I expect it will come for a long time. The device is expensive, as Colonel Rich pointed out, and it seems quite impossible for many years for a community by and large to provide that type of facility for the population. It may be that some economic investigation of this method of disposal over the other methods which require surface transportation might indicate to some small community that the utilization of the sewer for the transportation of this material might be more economical than the present method, but that remains still to be proved.

At the present time it is a matter of personal desire. It is rather interesting that there has been a development in the last month which is somewhat history making. The residents of Los Angeles evidently have a great interest in it and the matter was investigated by the municipality. The City Engineer presented a report to his Board of Public Works in which he said in substance this: Gentlemen, this thing is coming whether you will it or not. Now, we don't want it to come into Los Angeles uncontrolled, and therefore I recommend to you that there be a modification of our existing ordinance which will specifically specify the conditions under which this type of sewer disposal of household wastes can be carried out. The new ordinance was drawn and adopted and went into effect on August 24. It provides that the pulp produced must meet certain requirements as to sift size. They have discovered if it is reduced to a sift size specified, and incidentally those sift sizes are the sift sizes produced by the device now on the market, the material is satisfactorily water buoyant.

I don't know why, particularly, this whole matter has become so intriguing to these sanitary engineering groups unless it might be because we are people of service and if there is some possibility of taking the new utility and making it a greater utility, then that is sufficiently interesting to the engineer to make him investigate it very seriously. However, there is something I think even more important in the whole matter. We all complain seriously about the lack of interest on the part of the public; picturesquely, they pull the chain and so far as they are concerned that is the end of the story. Now, the use of a sewer has become pretty much second nature, but if the same public who uses the sewer unthinking today will suddenly awaken to the fact that they can dispose of their garbage can material by means of the same sewer, there should be a rebirth or revivification of interest in the sewer.

Now, I trust that that interest will eventually result in more funds for sewer maintenance, sewer construction and of much needed sewage treatment work. I do trust that perhaps this secondary service of the sewer may result in just that type of benefit.

PROGRESS ON THE MANUAL OF STREET CLEANING PRACTICE

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THE MAJOR task of the Committee on Street Cleaning during the year has been in connection with the preparation of a manual on street cleaning practices. The purpose and aims of the committee are expressed in the following foreword to the manual.

"At the Cleveland meeting of the Joint Administrative Board of the American Society of Municipal Engineers and the International Association of Public Works Officials in 1935, the Board adopted as a major item on the program of activities for the coming year the preparation of two manuals of practice, one on street cleaning and one on refuse collection and disposal. Each was to be the responsibility of the respective standing committee. It was intended that the manuals to be compiled could be used as authoritative reference books by those engaged in these activities and to serve as guides to the members and others seeking information as to standard practices. Accordingly, the Committee on Street Cleaning for 1934-1935, with the addition of several others was renamed, and charged with the preparation of the manual on street cleaning practice.

"It was the opinion of the Board that this work could be best accomplished by its being made the responsibility of a small sub-committee, to consist of the chairman and two other members. This sub-committee was to have the preliminary responsibility of determining the scope, plan, and treatment of the topic, and to assign to the other members of the committee the preparation of the component parts, and to work in conjunction with the headquarters staff of both organizations.

"In mid-January, 1936, a conference was held with the Executive Director and tentative plans were outlined concerning the scope of the work and the dates upon which certain objectives were to be reached. After some correspondence between the members of the sub-committee, a skeleton outline was formed, and the topics assigned to the various members of the committee for report. Upon the receipt of suggestions from the members, the outline was enlarged and distributed, a copy of which is attached. The subjects of Catch Basin Cleaning and Snow Removal were included, as it was felt that these are closely allied with the problem of street cleaning and are often included in the functions of a Bureau of Street Cleaning.

"Consideration of the problem in large and small communities entailed some considerable study on the part of the committee and to each of the subjects an

*COMMITTEE ON STREET CLEANING, 1936

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assignment of two members was made. It was expected that they were to work in collaboration and to enlarge and elaborate on the assigned subject. Opinions and contributions were also solicited from those outside the committee in order that a completely rounded picture of the problem might be presented. Letters were sent to some one hundred Public Works Officials and City Engineers requesting information and comments.

"At the suggestion of and in cooperation with the headquarters staff, a bibliography was prepared which included articles pertaining to street cleaning and its allied problems in the various works magazines and reports for the last six years. This bibliography was photostated and sent out for reference. It is felt that a fairly complete record of recent articles is contained in this bibliography and that it will prove of assistance to those seeking information on the subject of street cleaning."

As stated above in the Foreword, it was expected that the members of the committee would contribute the results of their experience and research toward the compilation of the manual. It has been found to be very difficult, however, to have these members take part in this work and it has been necessary for the chairman, with several others, to assemble the information and develop the manual from the outline.

The manual at the present time, which has 125 typewritten pages containing about 35,000 words, includes a discussion and data on eight of the ten topics of the Outline, or is approximately 80 per cent complete. The remaining two topics to be discussed, "Costs" and "European Practices," require somewhat more specialized treatment and are omitted until the time when more complete data and discussion are secured. The treatment of each of the topics has been that of an analysis of the particular subject with supporting illustrations of experiences of various city officials.

It was the hope of the committee that many illustrations in the form of photographs of equipment and photostats of records and forms would be in the manual to be submitted at the 1936 convention. Only the latter, photostats of the forms used in recording the work of street cleaning departments, have been included, there being forms from sixteen different cities.

The short time available to those engaged in writing and typing the first draft of the manual after the deadline set for the return of the individual committee papers on assigned subjects, made it impossible to devote the proper amount of time to its correction and revision. It is, therefore, submitted at this time as the preliminary report which must be revised and to which must be added that which was omitted because of lack of time.

The committee is agreed that the preparation of such a manual is a worth while objective and that the work done so far should be continued, either by the present committee or by a new committee. It is also recommended that a questionnaire be sent to officials requesting information on street cleaning activities and that the replies be incorporated in the manual in whole or in part.

OUTLINE OF MANUAL ON STREET CLEANING

I. Foreword

Authorization of Street Cleaning Manual by Administrative Board
Discussion of the Scope and Objectives—Definition
Assignments and Collaboration
Bibliography

II. Discussion of the Problem

- A. Reason for street cleaning
 - a. Effect on health, and so forth
 - b. Appearance of the city
- B. Adoption of a standard of cleanliness
 - a. Type of city—(industrial, residential)
 - b. Desire of citizens for cleanliness
 - c. Appropriations available
 - d. Degree of sanitation
- C. Limitations or factors affecting.
 - a. Subject to municipal control
 - 1. Organization and personnel
 - 2. Equipment available
 - 3. Methods to be employed
 - b. Not under control of street cleaning unit
 - 1. Types of pavement and state of repair
 - 2. Traffic conditions and parking
 - 3. Character of population in district
 - 4. Character of district (business, manufacturing, residential)
 - 5. Local wage scale
 - c. Other factors not controlled
 - 1. Climate conditions (snow, rain)
 - 2. Topography
 - d. Factors requiring cooperation
 - 1. Enforcement of anti-littering ordinance by municipal authorities
 - 2. Cooperation with waste collection units
 - 3. Publicity and education of citizens in prevention work

III. Organization of Street Cleaning Unit

- A. Policy of department
 - a. Contract or municipal
 - b. Single unit or combined with some other bureau
- B. Personnel
 - a. Sources (civil service or otherwise)
 - b. Selection of personnel for particular job
 - c. Control of personnel
 - d. Local wage factors
- C. Adoption of plan or system
 - a. District or other division
 - b. Number times to be cleaned
 - c. Time of cleaning—day or night
 - d. Size of gang or number of pieces of equipment
 - e. Other local problems

IV. Methods and Equipment to Be Used in Cleaning

- A. Mechanical
 - a. Selection of proper motor equipment
 - b. Motor pick-up sweepers—adaptability, limitations
 - c. Motor flushers
- B. Manual
 - a. Hand brooming
 - b. Hand flushing

- c. Discussion of above
- C. Collection and removal of sweepings
 - a. Equipment used for collections; cans, bags, boxes, and so forth
 - b. Kinds of vehicles, motor or horse drawn
- D. Disposal
 - a. Analysis of street sweepings and amounts
 - b. Dumping and dump control
 - c. Other methods of disposal
- V. Special Problems
 - A. Collection and disposal of leaves
 - B. All-night parking
 - C. Dead animals
 - D. Abandoned auto bodies
 - E. Cleaning of sand and cinders after winter thaw
- VI. Records
 - A. Complete and descriptive
 - B. Adoption of uniform definition of quantities—units of measure
 - C. Uniform system of recording work done
- VII. Costs
 - A. Adoption of uniform system of unit costs
 - B. Comparison with other municipalities of such cost units of mechanical and manual methods
 - C. Comparisons between methods regarding costs, accounting
- VIII. Catch Basin Cleaning
 - A. Importance of catch basin cleaning
 - a. Reason for keeping basins clean; flooding, odors, and so forth
 - b. Frequency of cleaning
 - B. Methods
 - a. Mechanical—eductor, bucket machine, etc., advantages and limitations
 - b. Manual—hand cleaning, advantages and limitations
 - C. Hauling and disposal
 - a. Equipment for hauling
 - b. Disposal of material
- IX. Snow Removal
 - A. Factors involved in snow removal
 - a. Amount of snow, temperature, time of winter season
 - b. Hindrance to business and traffic
 - c. Appropriations for removal
 - d. Policy and procedure to be followed in removal
 - e. Cooperation with U. S. weather bureaus
 - B. Organization for snow fighting
 - a. Recruiting of personnel for supervising force
 - b. Planning and setting up a schedule
 - c. Procedure to be followed in checking
 - C. Plowing
 - a. Equipment available (plows, tractors, etc.)
 - b. Routes to be followed
 - c. Depth at which to plow
 - d. Highway vs. urban plowing

- e. Amount of plowing considered necessary
- D. Removal
 - a. Proper distribution of supervision, labor and equipment
 - b. Hand labor and trucks
 - c. Mechanical loading, loaders, cranes, and so forth
 - d. Procurement of labor from various sources (contract, municipal, federal, relief, etc.)
 - e. Comparison of costs by hand and machine
- E. Disposal
 - a. Dumping in rivers, sewers, or vacant land areas
 - b. Necessity for supervision at disposal points
- F. Sanding
 - a. Amount of sand or cinders and discussion as to efficiency of both
 - b. Equipment used in spreading
 - c. Use of chemicals
 - 1. Sodium chloride, calcium chloride
 - 2. Results of mixing
- X. European Practices
 - A. Methods and equipment used
 - B. Results obtained

PROGRESS ON THE MANUAL OF REFUSE COLLECTION AND DISPOSAL PRACTICE

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Chairman of and Reporting for the Committee on Refuse Collection and Disposal*

AT THE time of its formation, the Committee on Refuse Collection and Disposal was instructed that its major activity during the year would be the preparation of a Manual on Refuse Collection and Disposal to serve as a reference for municipal officials and others interested in these activities. Accordingly efforts were concentrated on the preparation of a draft of the manual.

After much correspondence with the committee members and other interested persons, an outline of the scope of the manual was prepared and submitted to the committee members and to the Joint Board for review. The final form as approved turned out to be too much to digest. Further correspondence was carried on in assigning various parts of the outline for preparation of the text to the committee members, to Association members not on the committee, and even to persons not members of either Association.

The first draft of the outline is submitted to this convention. The Committee feels that this is only the beginning of what some day will be a really important work. The draft is deficient in many respects other than omissions of parts of the text. It is hoped, however, to furnish the foundation material for further expansion and coordination so that eventually it will be the municipal official's best guide in the conduct of his work in these fields.

With respect to the deficiencies, considerable research work is required to obtain necessary analytical material. Tables, graphs, and charts are very few in the draft presented, but it is hoped that illustrations will form an important part of the completed manual.

A few attempts have been made to inject a bit of philosophy into the text, especially where treatment is given to "what might be." Thus it is hoped to indicate ideal targets to shoot at.

Another feature which is quite evidently a most important one is the determination of current trends in practice. Such a determination would require a survey of numerous cities of all sizes. A questionnaire was prepared as a foundation work for this survey but on the advice of the Joint Board it was not pursued. It is recommended that further consideration be given to this matter of a trend survey in the later development of the manual.

The Committee regrets exceedingly that its concentration on the manual has not permitted a survey of progress during the current year. It is hoped

*COMMITTEE ON REFUSE COLLECTION AND DISPOSAL, 1936

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that this omission will merit forbearance in view of other problems with which the Committee was confronted.

We wish to express our appreciation of the cooperation afforded in the committee work during the past year by all who have been connected with it. Herewith is appended the tentative outline for the manual.

OUTLINE OF MANUAL ON REFUSE COLLECTION AND DISPOSAL

I. Foreword

- How the manual came to be written
- Purpose and objectives
- Plans for future extension and revision
- Sources of information
- Acknowledgments:
 - Materials used
 - Contributing authors
 - Editors

II. Statement of Problem

- Removal of all household solid wastes, and final disposal—subject to exceptions applying to local considerations—with full regard to sanitation, economy and adequate service. Cooperation of public.

III. Administrative features

- a. Department in control
- b. Municipal, contract, private or combinations
- c. Personnel organization and policies
- d. Control of facilities
- e. Financing: tax levy, special assessment, private, fees and charges
- f. Regulations and ordinances
 - Frequency of collections, separations, containers, place, time, penalties, exceptions (non-collection)
 - Control over scavengers or private collectors
 - Contract forms, provisions, and policies
- g. Programming
 - Budgeting, accounting, reports and records, performance ratings and comparisons, cost keeping
- h. Public relations, publicity releases
 - Complaint investigation and follow-up
 - Newspapers, radio, addresses, civic organization support, kitchen cards, annual reports, articles in periodicals
 - School and university cooperation

IV. Restatement of Problem

- a. Component parts
 - 1. House treatment, materials
 - 2. Collection
 - 3. Transportation
 - 4. Disposal
- b. To efficiently serve
 - 1. Householder
 - 2. Public

- 3. Administration
- c. Interrelationship of these seven items
 - Illustrative chart
 - Evaluations to be based on entire problem
- V. Waste Materials, Definitions, Descriptions, Limitations
 - a. Regularly handled
 - Garbage, rubbish or trash, ashes, dead animals
 - b. Not regularly handled
 - Lawn and tree trimmings, stable waste, auto wrecks, large metallic or other objects, waste crank case oil
 - c. Trade waste
 - By character or origin
 - Contractors, apartments, stores
 - d. Properties of the waste materials (selected types only)
 - Seasonal and climatic variations
 - Quantities produced per capita
 - Proximate analyses
- VI. House Treatment
 - Relationship to disposal methods
 - Separations, containers, etc., regulations
 - Control of quantities or volume
 - Enforcement vs. moral suasion
 - Inspection contacts
 - "Education" or "selling the idea"
- VII. Collection
 - a. Frequency and methods for different classes of refuse
 - b. Adaptability of equipment
 - Load capacity, motive power, loading height, materials of construction, loading and unloading details, safety features, methods of consolidation, overall efficiency.
 - c. Kinds of vehicles, comparisons
 - Motor truck, electric truck, tractors, trailers, animal drawn
 - Initial and operating costs
 - d. Organization and supervision
 - Size of crews, hours of work, daily tasks or routes, reduction of waste effort and unproductive time, balancing work among crews, control for peak conditions and seasonal conditions, use of crews on other work, set-out-and-set-back, exchange system
 - e. Personnel policies
 - Wages, incentives, injuries, compensation, fatigue studies, locker and wash rooms, uniforms, special requirements (gloves, care of equipment)
 - f. Special services
 - Complaint follow-up
 - Aid to other agencies or institutions
 - Other
- VIII. Supplemental Transportation
 - Large truck, trailer trains, rail, scow or barge
 - Management of facilities
 - Public reaction

IX. Disposal Methods

Effect on house treatment, collection and transportation; the end-product

Discussion of methods

1. Dumps

2. Sanitary fill, burial, plowing in, "controlled tipping"

3. Salvage

4. Hog feeding

5. Reduction

6. Incineration or destruction

Types of plants

Heat recovery

7. Garbage, grinding, central plant or household

8. Fermentation (Beccari)

9. Inoculation with and digestion by bacteria

10. Combinations, particularly with other municipal activities

X. Evaluations of Entire System

a. Appraisal with respect to sanitation, service, economy and dependability

b. Provision and control for future

c. The quest for profit through "by-product" or new "schemes"

d. Comparison of fertilizers from refuse with commercial

e. Evolutionary trends

Quantities produced, effect of general business activity, control speed—better service—higher costs

"Doubling up" on disposal plants by small communities

Efficiency and other surveys

XI. European Methods

Training of youth

Cooperation of public

Character of material

Methods

Frankfort-on-Main Congress notes

XII. Appendix

Bibliography

Model ordinances

Contract forms

Tabulation of disposal plants in operation

Selected cost data and statistics

DISCUSSION

MR. WILLIAM GALLIGAN (Chicago, Ill.): As you know, the members of the Administrative Board when they had in mind the publishing of these two manuals were very much interested in publishing the best text book that could be given to public officials for their guidance in their work. In assigning the two subjects to the committees, I think they picked the two best men they thought were available in the organization, and in my long experience and knowledge of the personnel particularly of our branch of the organization, I am sure I agree that they did pick the very best men they had in our organiza-

tion. Mr. Flockhart is young, conscientious, energetic, and one who thoroughly knows his subject as I think we all agree after listening to his report to-night. The same thing can be said of Carl Schneider. He has had considerable experience in his line and he is also energetic and conscientious and thoroughly knows his subject.

I believe these men are both entitled to a vote of thanks from the men present this evening from both organizations for the very hard and conscientious work they have put on the manuals so far, and which I know they will continue to put on them until they are completed. (Applause.)

MR. A. T. MANZLER (Rochester, N. Y.): I would like to know whether the completed manuals are to be placed into the hands of the officials for perusal. If that is done you will get a much better discussion of it.

MR. FLOCKHART: My understanding is this: After the Committee has made its report, it is submitted to the Board of Governors and they in turn pass upon it as fit for publication or not. I believe that is the procedure.

MR. H. J. CATES (Atlanta, Ga.): I think it is a splendid thing that we are not able to complete these reports at this time. I would like to say I had some small part in preparing a part of the manual on refuse disposal and right at this time I think we are on the verge of a great advancement in garbage disposal by incineration. I refer to the work being done on power generation, and I think within a comparatively short time this committee will be able to prepare a much better paper along that line than it has now.

MR. M. D. HAYES (Rochester, N. Y.): I have nothing in particular to contribute toward this manual, but I would like to mention the fact that the New York State Association of City Engineers has a model specification for municipal improvements. It was started several years ago and nobody could tell how long it was going to take to make it complete. However, when they started to revise some of the various categories they found out it would take several years to make each category complete when they went to all the places necessary, and so I made the suggestion that we take the data available to us at the time and get it out in loose-leaf form. These could then be issued to the engineers who would like to see something as a start, instead of waiting for a final bound volume supposed to be the last word on everything on the subject.

Now, it is an impossible thing to wait until the last word has been said on anything to do with engineering, so I think it might be a good idea on these manuals to get up a loose-leaf form of the things that are pretty well up to date and then put more research on the others. In that way somebody will get some things he wants.

MR. GODAT (New Orleans, La.): I have only recently come into public works and I feel pretty much as Mr. Hayes does that if these publications can be turned out in a form so that they might be used now by those who are new in the game, it would prove a help to them.

MR. T. R. KENDALL (New York City): The outline presented by these two committees tonight shows there has been a great deal of thought given to the entire problem, and it would seem to me distinctly disadvantageous to publish any portion of the report without the other parts which will go along with it. For instance, the disposal of municipal refuse is so closely associated with the problem of collection that were they to release the portion on collection without the discussion on disposal, some of the members might possibly be

misled in their choice of a collection system. So, I believe their idea of completing the manual within the next eight or ten months and then publishing a complete discussion of each subject is the best solution and will give the best results to the entire membership.

CHAIRMAN ROOT: I think we might make a suggestion to the *News Letter* that in a very early issue we print the main subject headings for each of these manuals, and then if there are some general suggestions which can be made on the part of anyone to the Chairmen of the Committees or to our Chicago Office, I know those suggestions will be appreciated. I do not think it would be out of place for the *News Letter* to contain for one month the outline for the street cleaning manual as presented by the Chairman of that Committee, and the next month the outline for the refuse collection and disposal manual as presented by the Chairman of that Committee, or perhaps both the outlines could be included in one issue without crowding out some other interesting data which comes to us through the *News Letter*. However, I would say let that information come out as promptly as possible.

MR. FLOCKHART: I would be glad to receive any suggestions.

CHAIRMAN ROOT: In this field of street cleaning as well as in waste collection, what is true today may not be tomorrow, and it can only be served as a guide for the future. Sewage treatment is not a settled problem and what may be good for one city is not good for another.

In the state of Ohio it is easier for us to spend twenty-four million dollars in an original investment for the solution of a public works problem than it is to find a hundred thousand dollars for its operation after it is built. And that is a consideration that applies not just in Ohio.

MR. W. B. SHAFER (Pittsburgh, Pa.): I think the manuals might be of some help in getting new members. If we were to broadcast that the outline of these two manuals was to be published in the *News Letter*, it would make a splendid selling document for those who are thinking of becoming members. I know that I shall use it that way

CITY AND REGIONAL PLANNING EXPERIENCE

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THIS REPORT, by necessity, is essentially preliminary in character, because of the difficulty of assembling the material desired for use at this conference. The horizontal and vertical spreads of the elements which provide the planning experience in question are considerable and much effort is required to reach fruitful sources. A handicap in reporting "experiences" is the reluctance met with in some instances to publish such information. The reasons for this attitude are obvious and must be given considerate attention. Under the circumstances, a large number of engineers and officials were contacted but the majority of the replies received were unsatisfactory for our purpose.

Beginning at the top with the National Resources Committee, there are various planning levels, which overlie practically the whole of the United States. These include: (a) Four super-regional organizations, i.e., The Tennessee Valley Authority, Pacific Northwest Region, Rocky Mountain Region, and New England Region. Each one of these regions includes the whole or parts of four or more states.

(b) Six inter-state metropolitan regions having as their respective centers the cities of New York, Chicago, Philadelphia, St. Louis, Kansas City, and Washington, D.C. Of these the first three include parts of three states; the next two, parts of two states; and the last, parts of two states in addition to the District of Columbia. The last mentioned is the only one of the six operating at present under definitely established statute. The others possess no fixed legal status and operate, for the most part, as unofficial planning agencies.

(c) Forty-six state planning boards set up under varying degrees of permanence and authority. The states without such enterprises are Delaware and Louisiana.

(d) At least one thousand county, city and town planning bodies, over twelve hundred cities that have zoning regulations in some form and over two hundred cities having comprehensive plans.

(e) Numerous boards and commissions that have been functioning for many years in planning activities in connection with the preservation and development of such resources as minerals, forests, water, agriculture, industries, etc.

Meeting these various planning levels at many points are the thousands of municipal and consulting engineers and public works officials whose daily duties bring them into contact with some phase of these planning activities.

*COMMITTEE ON CITY AND REGIONAL PLANNING, 1936

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It is evident, therefore, that there must be within this field a wealth of valuable experience along the lines attempted by this report. The problem is how to reach a sufficient number of responsive sources so that the experiences assembled will be clearly representative and weighty enough to carry conviction to planners.

Pending the compilation of a comprehensive report upon this subject, the chairman of the Committee on City and Regional Planning submits the following comments based upon personal contacts with organized planning movements, now in operation. This experience comes directly from official relations with and close observation of the following: Regional Planning Federation of the Philadelphia Tri-State District, incorporated May 1928; report published 1932; Philadelphia City Planning Commission, authorized by an Act of June 25, 1919, and Ordinance of April 13, 1929; first report published November 12, 1930; and several zoning commissions, authorized under the Act of June 25, 1919, a zoning code adopted under an Act of May 6, 1929, and an ordinance of August 10, 1933.

A continuing impression received, considering the city and regional planning movements as a whole, is that their greatest weakness lies in what theoretically constitutes their greatest strength—namely, in the fact that such bodies as a general rule are unofficial agencies functioning in advisory capacities solely. The desirability of this arrangement is still being emphasized collectively as a basic principal, but probably largely as a matter of sales policy. For example, the National Resources Committee in describing the work of the state planning boards, states: "Such a board will be useful in proportion as it is detached from immediate political power, serving as a technical tool of the democracy. In this field the intelligence and vision of a board, the respect and confidence it enjoys among groups whose cooperation is indispensable are far more important than large statutory powers or bristling governmental sanction." Again the same Committee, in referring to the five unofficial metropolitan regional planning groups, remarks: "They have the advantage of being in a position to give relatively detached, unpolitical consideration to the regional development problems; they are relatively uninfluenced by special political and private interests." The force of this latter argument is weakened by the continuing statement: "Conversely all have the disadvantage of being set apart from the directly responsible governmental administration so that their findings and recommendations may be, and in some instances have been, too easily ignored by official bodies."

The writer's experience with planning officials has been that no matter how unanimously they may subscribe in organized groups to the "advisory only" clause, individually, they openly deplore the lack of statutory support and declare in no uncertain terms for planning and plans that have "teeth." It is with keen interest, therefore, that we note and quote the following excerpts from the recommendations of the St. Louis Regional Planning Commission, which appear in the report on this region, published in June 1936 by the National Resources Committee.

"If the maximum benefits are to be obtained from planning within the St. Louis area, certain additional legislative action is essential."

The kind most needed is described under four types, of which the first only, "legislative," is repeated here.

"Legislation permitting the preparation, adoption and enforcement of official plans in local areas. A city or county plan should be consistently followed yet under the present legislative authority no plan can have official status and may be completely ignored by public officials. The plan for each administrative area should be officially adopted and any proposed improvement affecting any portion of the plan should be referred to the planning commission for study and report. Any project that did not conform to the plan and was so reported to the commission should not be undertaken unless it received a substantial majority vote."

These recommendations have a very familiar sound, but in this instance they come from a planning commission and not an individual. Our experience with advisory planning bodies and their programs and recommendations has been that advice from such sources is seldom sought. If given gratuitously, it may be tolerated but rarely heeded. Governmental bodies are preponderately political and frigidly cold toward all that does not readily respond to expediency and exploitation. The infrequent exceptions to this attitude are most apt to occur as the result of the leadership of some influential and far-sighted official or citizen. Under such circumstances, physical improvement through planning depends upon persuasion as much as education, and progress is deadily slow by either method. In the meantime, adherence to a policy of "advice only" is seldom effective even under favorable circumstances unless aided by a "political build-up." For the benefit of the uninitiated, a political build-up is a species of persuasion and not education.

The Philadelphia Tri-State Regional Plan has labored against the "advisory-only handicap" with greater success in certain outlying communities of the region than within its metropolitan center. From personal experience and current knowledge, we are able to record the fact that this regional plan has done much to activate local planning interest. Under this stimulus, certain elements of the master plan, in the nature of highways and parks and other recreational facilities, have reached the improved stage in various localities. These are affording valuable, practical lessons as to the advantages of a regional plan to the local community and to the region as a whole. However, successful as these experiments have been, the Tri-State Plan, which, by the way, is a very comprehensive one, remains but a plan as far as the city of Philadelphia is concerned. We venture the thought that there are probably very few in administrative offices who pause to recall its existence or if so appreciate, to any material degree, its purpose. Meanwhile the Federation is standing by in readiness to give advice supplementary to their published report. While waiting for such a call, let us consider city planning.

From our experience with the Philadelphia Planning Commission, which has been cordially intimate for nearly eight years, we have gathered some helpful experience in the practical workings of such a body. As a result, we are in a position to say a number of complimentary things about their constructive efforts, but our allotted time and purpose can best be served by considering certain important weaknesses rather than reviewing accomplishments. Therein lies progress. We, therefore, mention briefly five weaknesses, which, in our judgment, have handicapped the local commission at various stages of their work.

1. What has been said regarding the weakness of the "advisory status" of

planning bodies in general, applies with equal force to the local city planning commission. A striking illustration of this occurred in 1932-1935, during which period this commission received no official recognition whatsoever. Advice under such circumstances possesses no marketable value.

2. A structural weakness, in the form of organization adopted, developed soon after the commission began to function. It was caused by the irregular following of a policy apparently devised to strengthen the "advisory only" theory previously criticized. The principle in question is the personnel structure prescribed for city planning commissions by the Standard City Planning Enabling Act of the U. S. Department of Commerce, published in 1928. The ordinance authorizing the creation of the Philadelphia City Planning Commission is patterned, in part, after the standard act. It provides for certain members (twelve in this instance) to be appointed by the mayor with the qualification that they shall hold no office of profit under the city or county government during their incumbency as commissioners. We understand perfectly the theory behind such a provision but have witnessed on a number of occasions its impracticability under the conditions apt to control. Namely, the appointing authority, through an understandable lack of true planning perspective, seldom fully appreciates the qualifications that members of a competent planning commission should possess both individually and collectively. This criticism is made with all due respect to the authors of the enabling act and to those delegated under the procedure recommended and largely followed to appoint planning personnels. At least one member of a planning commission should possess a thorough knowledge of local administrative procedures, policies, and programs, including a practical working knowledge of the general legal and specific statutory controls involved.

Philadelphia has a number of long established municipal departments and bureaus, each operating under numerous acts, ordinances, and legal opinions. It also has a firmly established official city plan, which is likewise controlled by a complicated statutory code. Because the local planning personnel was framed to exclude any departmental representatives, the work of the commission has suffered from the lack of this essential tie-in. Obviously, City Planning Commission recommendations for improvements will receive scant attention if they require involved statutory enactments or conflict with established legal procedure or ignore current programs to which an administration is already committed.

The standard enabling act recognized the need of a connecting link with local administrations by including "an administrative official" in the commission's personnel with the suggestion that the said official might be the chairman of the park board, the city engineer, or commissioner of public works, the choice in any particular instance to be determined by the local conditions.

In framing the local city planning ordinance, this general class of official member was deliberately eliminated and replaced by the substitution of the following: "one member of the said commission shall be a member of the Fairmount Park Commission and shall be appointed by the Fairmount Park Commission." This body, incidentally, is not one of the city departments under the mayor and has no part in the planning or development of the city as a whole. Selfish ambition and politics were responsible for rigidly fixing this grade of membership and there was no misunderstanding at any time as to the individual for whom this membership was intended. By this short-sighted

action the planning commission was deprived of its only other opportunity to have representation from the municipal departments since the remaining two members provided for are councilmen. Active members of the commission have been outspoken in acknowledging the weakness of complete detachment between their group and the public works departments. On several occasions they have advocated the amending of the ordinance accordingly. However, no changes have been made in the original ordinance to date.

This delay was largely due to the fact that compensation for the lack of an administrative "tie-in" was partly made during the first three years of the commission's activities. During this period, the secretary of the commission also served as the director of the city's Department of Architecture and arrangements were made by him to have departmental engineers sit in with the commission's executive committee at their regular meetings. The present mayor has taken a step toward closer cooperation in planning by appointing a coordinating committee comprising the executive director of the Planning Commission, the directors of Transit and Architecture, the assistant director of Safety and the chief engineer and surveyor of the Department of Public Works. This body is functioning satisfactorily and its operations should increase in effectiveness as soon as complete cooperation is established. The plan is being supplemented at the present moment by the appointment of a liaison officer between the chief engineer's office and the Planning Commission's technical staff. These measures promise to minimize the disadvantages mentioned in the commission personnel.

3. Another weakness observed arises from a condition inherent in many appointed bodies—a weakness that applies particularly to those commissions required to perform a definite and oftentimes taxing service without compensation. Planning commissions should be fully qualified for such service by recognized attainments and possess ample free time to engage in this work. Political and personal appointments and "window dressing" should have no part in the choosing of planning personnels. If due care is taken in making appointments, there will doubtless be difficulty in finding persons fully qualified to serve, and liabilities are incurred by attempting to create a large commission. Where such is the case, it almost invariably happens that the bulk of the work falls upon a small minority while the majority, by reason of lack of time or true appreciation, contributes nothing. Such majorities, besides being a drag on the operations of the commission, are poor advertisements of the worth of planning.

4. The City Planning Commission, from its very beginning, has been handicapped by the lack of sufficient funds to operate efficiently. Prior to 1903 nominal budget appropriations were allowed sufficient to employ a minimum staff of technical assistants. This small unit was enabled to function successfully, largely by reason of the facilities made available from other sources. From the close of 1932 to date, no funds have been allocated to the commission by official appropriations. Spurred by necessity, it has taken advantage of federal grants under various relief agencies, i.e., CWA, LWD and WPA. With aid from such sources, the commission has continuously maintained throughout the course of these administrations a technical staff of between two and three hundred architects, engineers, and others. A number of valuable planning studies of worth-while projects have resulted and much research work has been undertaken as a part of their program. However, in order to keep this

small army of planners employed, it was necessary to engage in a wide range of projects outside of the normal field of planning commission activities. Included in this group were studies and reports of the city's sewer and sewage systems, water supply and distributing systems, garbage and refuse collection and disposal and transit. Inasmuch as the City of Philadelphia maintains well-organized departments and bureaus to handle such matters, this feature of the planning program was not very favorably received in administration circles, primarily because many of the investigators assigned to such projects possessed immature experience and judgment in such matters. Without in any way attempting to disparage the efforts of the commission's executive staff, for whom we have the greatest respect, it is our opinion that the work accomplished in the over-expanded phase of planning described, has little if any practical value. We will admit, however, that it did provide attractive work for the unemployed technically trained, thereby awakening a representative group of citizens to a degree of city planning consciousness which they previously did not possess. We believe that this education is an asset which of itself makes the investment worth while.

5. There is a tendency, among individual planners and planning commissions, to attempt the demonstration of the advantages of planning by strongly stressing the need to correct past mistakes—spending over-much time in replanning physical features that have been poorly conceived and badly executed. Such projects, while admirable in intent, are often too elaborately designed and frequently so excessively costly that the chances of their adoption and execution are remote. Another opportunity, therefore, to educate the public into a desire for the higher standards of civic life may be irretrievably lost. No opportunity should be missed to demonstrate the desirability of planning by creating as many examples of good planning as possible. The development of new areas will often afford the most direct means of accomplishing this end. But whether it be new planning or replanning, commissions find it difficult to plan and program their recommendations in such a way as to make their attainment possible with the resources available. Some day it is hoped they will begin their planning by first determining how much the municipality will have to spend for such things in a reasonable period of time; next developing a program of worth-while improvements, due consideration being given to their relative need; then estimating the cost to the community of each project; and finally setting up the estimated cost of the whole and comparing this requirement with the total amount of the available resources. It is our experience that if planners would learn to put a price tag on each improvement planned, they would hesitate considerably before proceeding to recommend some of them for adoption, assuming, of course, they have a full realization of the problems involved in financing such improvements.

Any fervent experience meeting among municipal engineers and works officials on city and regional planning must acknowledge the subject of zoning. Frankly, we are acutely conscious of our own experiences in the administration of zoning, which is now well advanced in its fourth consecutive year. This contact has brought the firm conviction that zoning is not a magical process capable of making a happy issue out of all our city planning afflictions. Zoning is so beset with problems arising from unbridled human desires and failings that its value as a planning agency is discouragingly low. In our opinion, zoning

is faltering not on account of any basic weakness in its theories, but because it is submerged by levels permeated with hopeless antagonisms born of political capitalization, ingrained selfishness and neighborhood spite. Local experience has emphasized the difficulty of devising regulations satisfactory for zoning both old and new areas. Attending weaknesses are the absence of a rightful sense of responsibility on the part of many applicants, the tendency to violate wilfully the established regulations, the inability to provide sufficient inspection service, and lack of support in the attempts to penalize for flagrant violations.

A much needed help to zoning is the physical development of a sufficient number of unimproved areas in a manner that will effectively create in visible form a true expression of the worth of zoning. As long as the majority of local zoning cases are thinly spread in great areas of old, conflicting, and zoned non-conforming land uses, compromises, exceptions, and variances will be numerous. The inevitable result is that the bulk of the city will be disappointingly slow in responding to the beneficial influence of zoning. It appears that a zoning code, if well conceived, stands in need of an extensive building program. When this much desired change occurs, zoning must remain firm so that no valuable ground will be lost, otherwise the bruising struggle and the patient waiting will have been in vain.

Finally, in summarizing our experiences in city and regional planning, including zoning, we believe that the greatest handicap to progress toward these fair goals has been and will continue to be spiritual. Thomas Adams pointedly reminds us in his *Outline of Town and City Planning* that, "the real distinction that exists between communities is in spiritual rather than in topographical or economic conditions. Spiritual in the sense that it is the product of forces connected with different ideas and levels of intelligence, in which culture, social habits, public spirit, and traditions have different values." It is our judgment that in these profound words of wisdom Mr. Adams places his finger upon the basic cause of many planning difficulties we have observed in our experience. Large American cities are typically cosmopolitan in structure and, being so, consist of a number of distinct community elements between which the spiritual qualities outlined above may vary greatly to the detriment of planning—both city and regional.

Planning, as a movement, is often criticized for its slow progress, when, as a matter of fact, the very best efforts of the planner are ineffectual unless supported, to some degree, by one or more of the spiritual forces mentioned. In our opinion, planning today—as result of this requirement—is confronted with a paradoxical situation that many planners do not fully appreciate. They spend much time in making plans as the means whereby the spiritual qualities of the community may be raised; whereas actually, under existing conditions, this latter improvement must occur before there can be any appreciable acceptance of the former. We believe that as long as our present form of government exists, planning progress, as measured by physical accomplishment, will be condemned to "slow speed ahead" if it continues to depend upon the making and acceptance of plans. Planning to prevail in a scale commensurate with its opportunities must spend less time upon the making of plans and more time upon the laying of a sound foundation for their acceptance. Such planning as is done during this process, to be helpful and not harmful to the cause, must be along the lines laid down by precept taken from the writer's diary of the Third

National Conference on City Planning, held in Philadelphia, 25 years ago; this is: "In our planning, let's avoid, as far as possible, both ignorantly wasteful action and ignorantly wasteful inaction."

DISCUSSION

MR. P. L. BROCKWAY (Wichita, Kan.): Some few years ago I read a novel of uncertain authorship and in the descriptive part of the book the author writes not only of himself but he writes: "We have a City Planning Commission in our city and we have a city plan prepared by one of the most successful city planning engineers and the plan has done us a lot of good." But, in that connection he made the statement, and I heard him say it many, many times, that the hardest thing a city planning engineer had to do was to attach the spirit to the problem that was mentioned in the last part of the paper—and by that I mean the mental attitude toward city planning in the City Engineering Department itself. I think he made the statement that has been made repeatedly: that the failure of a city plan, when it does fail, is many times dependent on the hostile attitude of the City Engineering Department. You can draw your own conclusions, but that is what I heard. In this symposium this morning it occurred to me that after all the most important and the central function of a municipal engineer and a municipal administration is planning. And municipal planning is one of the most important branches of city engineering. It is certainly not wise for a planning organization to stand on the outside and criticize and say they don't know anything about our problems. They should find out—and join in the solution.

THE SLUM: ITS COST AND CHALLENGE

F. J. C. DRESSER

District Manager, Housing Division, Cleveland, O.

JACOB RIIS in his book *How the Other Half Lives*, written forty-five years ago, called attention to the slums in our growing cities, and pointed out the social and economic consequences. Since then other enlightened individuals such as Jane Addams, Edith Elmer Wood, Mary McDowell, and others, have continually brought attention to the same subject. In 1926 Franklin D. Roosevelt, in a speech delivered in St. Louis, stated it was time we thought of reconstructing our cities, and urged a national slum clearance undertaking.

But from Jacob Riis' time until the present, little was done in regard to the elimination of slum areas, and as a matter of fact, they grew in relative proportion to the growth of our cities. They constitute today cities within cities and are named, according to an earned reputation: "The Lung Block" and "Devils' Kitchen" in New York City; "Monkeys' Nest" in Youngstown; "Little Hell" in Chicago; "Roaring Third" in Cleveland; "The Basin" in Cincinnati; "The Arks" in Memphis; "Sausage Row" in Columbus; "The Corrals" in San Antonio, and many others equally appropriate. These areas in all cities are growing in size each year.

Chicago, whose metropolitan area covers 215 sq. mi., and whose population is approximately 3,660,000, has 36 sq. mi. of slum and blighted area, in which a million people live. Other cities are proportionately as bad.

In this country taken as a whole, we find that of the total population:

Twelve per cent live in 5 metropolitan cities, each with a population of 1,000,000 or more.

Twenty-three per cent live in 186 large cities, each with a population of 50,000 to 1,000,000.

Twenty-one per cent live in 2,974 small cities, each with a population of 2,500 to 50,000.

Forty-four per cent live in 13,443 villages and on millions of farms.

We have worse slums in little towns of 5,000 and in cities of 100,000 or 500,000 than the big towns ever saw, and living conditions are equally bad in many farm houses.

It is estimated that 60 per cent of our farmers have automobiles, 40 per cent have telephones, 12 per cent have electricity and 5 per cent have running water. In other words, the house pattern is almost the same as it was 100 years ago, while the automobile and telephone are up to date.

What is the housing problem today, and what does a housing program involve? We may begin to answer this by saying that at least 50 per cent of our population cannot be taken care of by private enterprise, which caters to those who can pay the costs, rates of interest, and profits necessary for its working. The unfortunate 50 per cent cannot afford a rent for which private enterprise can provide the minimum standard of dwelling that the community must require for its citizens. Hence the Housing Problem.

It is the most universal interest in slum clearance and low cost housing that assures the solution not only of the problems they present, but of the larger economic problems of which they are a part. For we have come to know that

the measure of a nation's civilization and prosperity is its standard of living—its Housing.

The housing of the great group of people whose income falls in the lowest classification is not a new problem. That group in all ages, including our own, has lived and does live in wretched quarters that may be called shelters, but could never be properly called "homes."

People of low income must wait for buildings and neighborhoods to be completely run down before they can afford them. Beyond merely physically decent houses, proper housing requires good environment, recreational facilities, community life, easy access to parks, places of employment, and shopping centers, and reasonable freedom from noise and traffic dangers. The requirements involve recasting our cities into logical organisms for their job.

It was the demand of factories for labor during the industrial evolution—an abundance of *cheap* labor—that brought an ever-increasing population swarming into the inadequate quarters of the towns and cities. Without established public standards of health, with no public water supply, sewage disposal, street paving, or refuse removal, the inevitable result was pestilence, famine, social and economic disorders. The confused mixture of houses and apartment buildings, factories and industrial buildings, is typical of the city's unplanned growth. This leads to unequal taxation for some, poor living conditions for all in such an area, and the destruction of property values.

In those early days, no one assumed responsibility for housing conditions. During the last fifty years, public bodies, together with civic, educational, and labor organizations, have brought about a large measure of governmental assumption of responsibility for housing conditions. The tremendous value of that assumption of public responsibility is too well proved for us not to believe in and plan for a comprehensive enlargement and extension of it.

We know, beyond question, that the misery and overcrowding of the slums form the soil of anarchy, the breeding place of crime, the environment that causes physical, mental, and spiritual disintegration. The annual crime cost in the United States is thirteen billions of dollars. An inhabitant of the United States is murdered every forty-five minutes. Our homicide ratio last year was 10.7 per 100,000—the highest in the civilized world. England's is 0.5. There is an average of one burglary committed every minute. Some 140,000 Americans are in prison; some 400,000 regularly engaged in criminal activities.

The tremendous growth of our cities during the development of our industrial era, or rather the rapid growth—uncontrolled in many instances as to plan—was occasioned by the fact that during the time that this nation changed from an agricultural to an industrial nation, more and more people were obliged to move into the cities to seek a livelihood.

The reason is apparent in the following international analysis made by Dr. Friday. He finds that in Russia it required the efforts of 87 people during one year's time to produce the foodstuffs that 100 people would consume in a year's time. In Italy the figure is 60; in France it is 50; in Germany it is 40. In the United States the figure is 20. That is to say that 20 people will produce sufficient foodstuffs in one year's time to provide food for 100 people in this country; or, in other words, 80 people out of every 100 in this country are obliged to seek a livelihood either in service or industry.

As our country grew, this labor coming from the agricultural sections—and our country at the outset was 100 per cent agricultural—was readily absorbed

by our growing industrial plants and our cities; but during the last twenty years we have faced a new problem by the introduction of the machine in industry, and today we have so mechanized virtually all industry and specialized all industrial workers, that it results in the tremendous unemployment problem as it exists today.

To visualize a little more clearly how rapidly this country has grown, I will present it in another way:

When George Washington was President of this country in 1789, the population was approximately $4\frac{1}{2}$ million people; in 1860 its population was 32 million, and the census figures for last year show a population of approximately 126,425,000. In 1866 the postal receipts were 15 million dollars, and they were virtually doubled every ten years following with not a break-down until 1930, when the total receipts were 705 millions of dollars. The two years following, they dropped 200 million dollars—so that the receipts as of 1932 were practically on a par with those of 1922.

This is another way of visualizing the terrific rate of growth which is responsible today for the congestion and, so to speak, for the general housing conditions in virtually all of our industrial cities, and to the end that a great proportion of our areas are in the slum and blighted condition, because there were no regulations as to housing.

A great number of these areas have been in existence for many years, and enlightened writers have been endeavoring to point out what social and economic costs were involved. Only in the last few years have we become nationally conscious of the true situation of housing in this country, and the *actual cost* to a community of these slum and blighted areas.

As to the *cost* of slums, one such area was surveyed in the city of Cleveland. This analysis involves a detailed study of land and building values, the income from real estate taxes, and the itemized accounts of the various expenditures necessary to maintain and operate a neighborhood. The particular area in question had 22,236 inhabitants in 1930, living on 333 acres of land, which amounted to $2\frac{1}{2}$ per cent of the population of the entire city, and .73 of 1 per cent of the land area. The total population of the area in 1910 was 24,647, increasing to 30,440 in 1920—a $23\frac{1}{2}$ per cent increase, and decreasing to 22,236 by 1930—a 27 per cent decrease. Those of you who know the city of Cleveland might definitely locate it in that it lies between 22d and 55th Streets, between Central and Woodland Avenues, 22d Street being approximately a mile from the heart of the city.

The survey, beside covering the number of families and the percentage of the number of families and their respective sizes, covers a racial proportion and the analysis of the entire population by race, by general nativity, and covers, of course, the family units occupied and vacant. It analyzes as well the question of crime, which is found to be predominating in this section. This is indicated by the fact that of the 998 murders committed during the past twelve years in Cleveland, 213 or 21 per cent of them were committed in this section; that of 373 houses of prostitution found in Cleveland in eight under-cover surveys made between 1927 and 1928, 98 of the houses or 26 per cent were located in this section. Delinquency is frequent in this section. This is indicated by the fact that of the 6,614 boys brought into the Juvenile Court during the four years of 1928 to 1931, 447 or 7 per cent of the cases came from this area. The figures on illegitimate births in 1928 show 10 per cent of the mothers lived in

this section. Deaths from tuberculosis in Cleveland during the four years 1928 to 1931 amounted to 3,127. As many as 392 or 13 per cent of these deaths occurred in this section. So much for the social conditions.

The net service cost of the section to the county through mothers' pensions, juvenile court cases, tuberculosis cases, child welfare cases, soldiers' and sailors' relief committees, amounted to \$132,396 over and above the revenues received in taxes during 1932.

The analysis of the costs of direct services to the city of Cleveland—in other words, the net cost of this section to the city—amounted to \$728,365 over and above the revenues received in taxes. The net cost of the section to the Board of Education amounted to \$271,182 over and above the revenues received in taxes. Considering again that we are talking about a slum area whose population is only 2½ per cent of the total of the city, let us look at the item of fire protection. That alone costs \$406,159 and amounts to 14.44 per cent of the total cost of fire protection service to the city of Cleveland. Police protection costs \$255,596, or a total of all expenditures in the city of 6.47 per cent. Relief and social service, in addition to the figures given before, cost \$728,702, or a total of 8 per cent of all relief moneys spent in Cleveland in 1932. So, all told, the community put \$1,750,000 into this section in excess of the money that it received in real estate taxes in the section. A total deficit of this amount of money is accounted for. Without any doubt, if administration expenses and each and every other minor expense were taken into account, the cost of maintaining this small section of crime, vice, and delinquency would have increased to \$2,000,000 or possibly \$2,500,000 for the year 1932. However, the annual loss of \$1,750,000 dumped into this one small section should be enough to make the entire country recognize the need for a close examination of the causative agents and should proceed to change the character of our slums. Similar surveys in other cities account for like costs.

Today there are few citizens who are not deeply concerned over the problem of the millions of people in our slums; few who are not interested to discover some way of eliminating the disease-breeding hovel, the miserable basement, the tottering, rat-infested tenements, many of them long condemned by boards of health, building and fire inspectors, as hazards of life, health and property even *far beyond the areas* of the slums themselves, and public responsibility for the establishment of and the maintenance of an adequate minimum standard of housing is rapidly being accepted.

A comparison of service costs involved in police and fire protection, as regards this slum and compared with the other sections of the city, produced the following illuminating answer:

FIRE PROTECTION COMPARISON

Area	Cost per \$1000 Appraised Value Land and Buildings	Cost per \$1000 Appraised Value of Buildings	Cost per Capita per Sq. Mi.
Slum Area	\$49.81=100%	\$81.47=100%	\$35.13=100%
Lakewood	1.49= 3%	2.27= 2.8%	.40= 1.24%
Cleveland Hts.	.88= 1.8%	1.35= 1.5%	.25= .71%
East Cleveland	1.43= 2.9%	2.12= 2.6%	.69= 1.96%
Shaker Heights	.63= 1.3%	1.04= 1.2%	.38= 1.08%
Cleveland	2.59= 5.2%	4.40= 5.4%	.44= 1.25%

When fire protection in a residential suburb costs \$.63 per \$1000 of appraised value of land and buildings, \$.50 seems too large for a section of slum area annually increasing in size and decay.

POLICE PROTECTION COMPARISON

Area	Cost per \$1000 Appraised Value Land and Buildings	Cost per \$1000 Appraised Value of Buildings	Cost per Capita per Sq. Mi.
Slum Area	\$31.35=100%	\$51.27=100%	\$22.12=100%
Lakewood	1.55= 4.9%	2.37= 4.6%	.41= 1.9%
Cleveland Hts.	1.14= 3.6%	1.74= 3.4%	.32= 1.5%
East Cleveland	.69= 2.2%	1.03= 2.0%	.33= 1.5%
Shaker Heights	.67= 2.2%	1.09= 2.0%	.40= 1.9%
Cleveland	3.63= 11.6%	6.18= 12.1%	.62= 2.8%

When police protection costs \$4 per family in a residential suburb, \$58 seems high.

These comparative figures issue a challenge in the shape of replanning and reconstructing these areas to the end that costs can be reduced. If fire and police protection costs could be reduced to the city average, enormous savings are possible as shown in the following total. These slum areas as they exist today are fire hazards in a great many instances, and building fireproof buildings naturally cuts the cost. In the following total of possible savings, it is assumed that the cost given be cut to the general city average as quoted. The areas, of course, are replanned and rebuilt, eliminating the needless streets, cutting down the street cleaning item as well as the street lighting, and the fact that the buildings have incinerators cuts the garbage collection cost. The potential total saving amounts to the staggering figure of \$637,741 annually, certainly a possibility worth further investigation.

POSSIBLE SAVINGS

1. Fire Protection			
Cost in Area		\$406,159	
City Av. 5.2%		<u>21,121</u>	
	SAVING		\$385,038
2. Police Protection			
Cost in Area		\$255,597	
City Av. 11.5%		<u>29,394</u>	
	SAVING		226,203
3. Ash-Rubbish	Cost	\$11,450	EST. SAVING 6,000
4. Garbage Collection	Cost	\$13,079	EST. SAVING 7,500
5. Street Cleaning	Cost	\$ 2,419	EST. SAVING 1,500
6. Street Lighting	Cost	\$18,570	EST. SAVING 10,000
7. Sewer Maintenance	Cost	\$ 3,128	EST. SAVING 1,500
	TOTAL SAVING		<u>\$637,741</u>

The figures herein quoted are taken from the Real Property Inventory, an analysis made in the city of Cleveland under the direction of Howard Whipple Green, and further analyzed by Father Naven. This, in no way, is any reflection upon the city of Cleveland, because it was the first city that actually sought to get the facts in regard to slum costs. Since then, other cities have followed Cleveland's example and we find results equally illuminating in Boston, Chicago, and elsewhere. Let it be said to Cleveland's credit that after the facts were revealed, all civic, social, and political bodies joined in the movement to eliminate these slum areas and as a result it is the only city that has under construction today three distinct slum clearance projects.

In the slum areas of any city you will find for obvious reasons no new homes being built—and to expect a reclamation of these areas on a unit or lot-by-lot basis is out of the question. It can be done only on a mass area basis, and not then, until some arm of municipal control is given the right of eminent domain for the sake of public health and public morals. England and other countries have such control.

Reconstruction also demands planning to the end that we will attain the ultimate in land utilization in accordance with present-day needs, no matter whether that land is to be used for streets, industry, commerce, or residential purposes. In other words, have or prepare a plan.

Generally speaking, most cities have little factual data regarding themselves; that is why the Cleveland survey and others are so revealing. Besides the slums, you will find in many cities a real need for rehabilitating the water and sewer systems, streets, and service equipment generally, if the facts are analyzed.

Millions are in idleness and want, and there is no worse use to which society can put a human being than to keep him in idleness and privation. And this great human *need* must and shall be converted into effective, constructive, economic *demand*. Housing is one of the instruments by which that transformation will be brought about.

The plight of our idle millions is due to our failure to realize with sufficient clarity our economic trend and the necessity of planning and performing collectively. To think and act nationally is a necessity of the times.

Abram Garfield, chairman of the City Plan Commission of Cleveland, says that "during the past 25 years, since the automobile has brought the outer limits of the 20-mile radius within easy reach of the center, we have made accessible, by means of well-built roads, almost all of the 600 sq. mi. area, which is more than eight times the area of the 70-mile city. We have observed further, that the whole population of city and outside area together has only doubled during this period. We have shown that everyone, whether he owns land or not, whether he lives in the city or in the outside area, is helping to pay for this expensive improvement, so that on the average, everyone has a property to maintain that is four times as large as it was before the population doubled."

In regard to planning, he further states: "We can say, in passing, that there is no likelihood of the population inside the city limits ever reaching two million. People are tending to move out rather than to stay in; if we want them to stay in and, for that largest number who have to stay in, we must rearrange the city so that they will be more comfortable. When we can afford it, we may take advantage of the new planning and for one thing, we can have parks covering a quarter of the whole residential area of the city and still

have room enough for everyone who lives inside the present limits. The fact is we cannot afford not to do it."

Modern thinking so far as replanning cities is concerned, aims in the following direction:

1. The mass continuity of our cities as it exists today should be broken up.
2. In the so-called gridiron layout as it exists today in most cities, 30 to 38% of the land is devoted to streets and alleys. We have discovered that we can build neighborhood centers and serve these areas adequately by devoting only 15% of the land to streets. It is intended, therefore, to take the surplus land now used in streets and alleys, and convert it to open areas, recreational centers, and parks.
3. The residential areas or neighborhood centers should be built away from the arterial streets in the interest of safety.

For a long time we were so intent upon inventing labor-saving machines, and on turning out standardized products in large volume; so busy increasing the capacity of factories and of plants; so engrossed in supplying a large foreign demand for our products (which were to be paid for—and were not—with money loaned to those foreign customers), that we lost sight of the vital fact that machines were saving so much human labor that, unless an ever-increasing demand were maintained, serious and continuous unemployment of human labor would result. To put it another way, we were saving an enormous amount of labor time—were acquiring a huge surplus of it, so to speak—but were declaring no dividends to distribute it. And the value of any surplus lies in its intelligent use, its wise distribution. Man power, bank credit, machinery—all have little value except when used.

So we were confronted with a huge surplus of man power that we were not using, and which therefore represents a loss—not only an economic loss, but a social one. The depression has thrown the problem of overcoming that loss suddenly and unceremoniously into our national lap. And in the study of that problem and the present condition of affairs, those of greatest vision are less troubled by the financial breakdown than by the breakdown in character. Any solution demands the employment of means that will restore both financial credit and character. Housing is one large contributing factor to that desirable end.

Let me quote from an article by Newton D. Baker relative to this subject. He said:

"We have more than our physical environment, more than houses, the factories, banks, railroads to put in order. We have human lives also to rebuild. Before that can be done, the institutions undertaking that humane function in our American scheme of things must themselves be rebuilt if the work is not to fail us in this unparalleled emergency."

Slum clearance housing will prove a great factor in the rehabilitation and the preservation of character. The wealth and permanence of a nation is determined by its *man power*—the ability of its people to abundantly produce, to consume, learn, think, fight, work, play, invent, and to aspire.

Wealth embraces all useful things which can be appropriated and exchanged. It is the amount and quality of the man power of a nation which determine how well and to what extent appropriation and exchange will take place. Make a decent home possible to those, at present, disinherited millions in our slums, and character will grow. Guide the groping hand of

the unfortunate to the first rung of the ladder and the independent pulling power of that grip is an outstanding demonstration of the force of encouragement and hope.

There are many small problems—vexatious, retarding details—with which we must grapple as we push along the work. Problems that involve the enlightened cooperation of municipal, county, and state authorities: the establishing of more comprehensive city planning programs, clothed with greater authority; the revising of building codes; the establishment of competent management—the essence of success in these housing enterprises. These problems will be worked out and methods perfected. But it is the great national *will* of our people to do this thing which assures the solution of its problems and the success of the program, because it is a fundamental economic necessity and is not a political issue.

We are a nation of builders. No nation was ever great that was not a nation of builders. No nation will continue to be great that is not a nation of builders.

In this slum clearance housing program lies the greatest challenge and appeal to our historic national ability, our national character and our indomitable national *will*—for, by it, we will at once make our country not only a better place to live in, but a more profitable place to do business in.

DISCUSSION

WALTER H. BLUCHER: A few years ago Herbert Hoover called a conference on low cost housing in Washington, and as one who had been interested in the housing movement for a number of years, I went to the conference and at the same time I stopped in to see the Senior Senator from Michigan, James Couzens. I tried to sell him on the idea of doing something for low cost housing, and after he heard my story he said, "Man, you have the cart before the horse. The first thing you have to do is to provide a decent income for these people so that they can pay for good, low cost housing." I don't want you to misunderstand me. I am in favor of public housing, and I am in favor of the public housing program of the Public Works Administration. I submitted the first public housing project to the Public Works Administration in Washington. But, as a result of Mr. Dresser's paper I am convinced of one thing, and that is, it is hell to be poor.

There is ample justification for a housing program. It is my personal opinion, however, that any housing program has to be decentralized more than the present program, and that it is primarily a matter of local responsibility with some state and federal aid. I think that the justification for any housing program has to go beyond the indices of juvenile delinquency and things of that kind. For instance, if we take the same people living in the slum area and put them in fine houses and do not give them a suitable income, what is going to be the result? The people who have no income are going to be dependent upon others for help and because of malnutrition, there will be a high rate of pneumonia and a high rate of tuberculosis, and the man who is not receiving anything is apt to steal. Therefore, I don't necessarily see any relationship between juvenile delinquency and things of that kind and poor housing.

There is a relationship to poverty, but unless we eliminate poverty, I don't think we are going to get very far with our housing program.

There are some interesting figures in Mr. Dresser's paper. For instance he

made the statement that the rate of crime in the United States is about twenty-two times higher than that of England. Well, the "finest" slums I have ever seen in my life are those in England, in Manchester and London. That is no reflection on England, but the mere fact that they do have some of the worst slums as against our slums shows there is not necessarily any relationship between crime and housing.

A very interesting thing happened in Manchester. That city admits having some of the worst slums in England and, in order to remedy the condition, they have built a new garden city and are moving some of the slum dwellers out to Wythenshawe.

Recently we had a delegation of British Police Chiefs visiting in this country. I lunched with them and asked the Police Chief of Manchester about the cost of crime prevention. He said that the cost of crime prevention in Wythenshawe is higher than it is in Manchester proper and in the slums for the very obvious reason that the people in the slum areas are concentrated whereas in Wythenshawe they are spread all over. So that again proves that cheap housing does not necessarily eliminate crime.

Now, if we are going to admit that the people of the United States are not entitled to a decent income, a decent living income with which to pay for decent housing, then I suppose we are going to have to subsidize them in one way or another. You can subsidize them with good housing or subsidize them by paying for municipal services or through relief. You have your choice.

The other interesting thing to me about the public housing program, and remember I am in favor of it, is this: The federal government has completed one project, but we can't tell yet what the rents are going to be in this or the others under construction. However, I doubt very much if the people living in the slum areas are the people who are going to be rehoused in the new buildings. That is a very important statement. I think it is erroneous to talk about clearing the slums because the people living in them are unhealthy or are criminals or delinquents, and then place an entirely different class of people in the new buildings. Many of these persons living in the slums about whom we are so solicitous, are paying rents of three or four dollars per room per month when they do pay any rent at all—while the new rents, even with the subsidies, will be several dollars per room per month higher. In other words, the people who are the delinquents and the criminals presumably because they live in the slums, the people who are creating a charge against the municipality through hospital cost and through inability to pay taxes, are not the people to be rehoused in the new buildings. We ought to admit that they cannot be rehoused in these new buildings and that some other form of low income dwelling must be built to take care of them.

There is one other thing I would like to talk about and then I am going to stop because I could talk about it until you are all tired out, and that is the matter of planning in the building of houses. We ought to keep in mind the distinction between slum clearance and slum rebuilding. Just because we have a slum does not mean we ought to rebuild that slum with housing. That slum area might be the proper place for an incinerator, or it might be the proper place for a park or a playground, or it might be the proper place for industry or commerce. I admit that in most of the cities of America we have too much space for industry and too much for commerce and I further admit in all probability the best use for much of that land is for low cost housing

if we can get the land cost down, but it does not necessarily follow because we clear a slum we should build houses in that area. As I see the housing problem it is just a part of a program for rebuilding our American cities. I think that is where the Public Works program can fit into a planned program. It is not enough to take the slum land and put houses on it, and it is not enough to buy cheap land and put houses on it. The houses must be built in relation to a general plan for the building of a whole community. If we are going to make our American cities decent places in which to live, we have to start a general program for rebuilding, and that program entails housing, sewers, streets, water mains, and all other public services.

What we have to do in the location of any housing project is locate, not because the area is a slum, not because the land is cheap, but in relation to all the other factors: where people are working, what is the trend of the population, and all the other factors that must be considered. The housing project must not be an incidental or a small segment thrown in wherever possible, but it must be a part of the general scheme for the rebuilding of a community.

I noticed a very interesting thing in the newspaper here yesterday. There is a big argument on housing, and one of the reasons given for not appointing a new housing commission is that Toronto cannot do anything toward the rebuilding of new houses until the town has been adequately zoned and planned. That I think is a very pregnant statement, and it is a very sound way to approach a housing program. It is the only way you can do it properly—make a general program for the community and not something to be stuck in wherever possible.

CHAIRMAN BROWN: Are there any further comments on that subject?

MR. W. W. DEBERARD: I have a letter here from Miss Elizabeth Wood, Executive Director of the Metropolitan Housing Council of Chicago, commenting on Mr. Dresser's paper. With your permission I shall read it.

Dear Mr. DeBerard:

... My first reaction when I read over these Cleveland figures was that the conclusion necessarily to be arrived at was not that rebuilding the area with good houses would reduce municipal expenditures by any appreciable amount, no matter how perfectly buildings and streets might be replanned, but rather that the situation existed because the people were poor and reclamation of the physical area simply allocated tax expenditures to another and perhaps better use. In other words, you cannot expect taxes from people with low or no income sufficient to cover their municipal costs. At the present time we take care of the situation by giving them a totally undesirable commodity.

Regardless of how or where they live, we would have to pay their street services and schooling and relief charges. Nobody can ever convince me of the fact that if these present tenants were rehoused in governmentally built housing at the present time in a model neighborhood that the cost to the city would be less than their present cost. The reduction in "savings" due to better planning, fire and police would be completely lost in the increased expenditure in the construction, operation and maintenance of the new buildings. I wish people would stop kidding themselves about this fact.

I have been confronted so powerfully the last few weeks with the fact that because the government (at the present time the municipal, state and federal

government) is failing to recognize that an important part of a housing program during the depression is rent relief. Many neighborhoods here in the city have gone to wreck and ruin in the last few years due to the fact that a large proportion of the population is poorer even than usual,—that is, on relief. The relief agencies have not paid rent, and therefore structurally sound buildings in potentially desirable neighborhoods have been utterly ruined. This process, that we have seen during the depression, is simply an exaggeration of the process that has taken place in many desirable neighborhoods because of the fact that people were not able to pay sufficient rent. It has seemed to me that if you take the city as it now is, one of the most important factors of a housing program is an adequate system of rent relief so that owners of desirable buildings can maintain them during the period of the physical life of the building. When this sort of program is accompanied by intelligent neighborhood planning, the first and most important step in municipal housing programs has been taken. The major burden that the municipalities or any other branch of the government has to carry is in regard to the relief, or near-relief families.

ELIZABETH WOOD
Director

PROGRESS IN MUNICIPAL FIELD ENGINEERING

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Chairman of and Reporting for the Committee on Municipal
Field Engineering*

DURING the past year there has evidently been only nominal, routine progress in general ground surveying throughout the country, but great activity in aerial surveying. Information gathered from members of the committee in various parts of the country, and the bibliography of magazine articles and books included in this report both point to this conclusion.

Canada has engaged in mapping from the air by photographic methods more extensively than any other country of the world, according to the Department of the Interior of Canada in Topographical Survey Bulletin No. 62. "The mapping of half a continent is a tremendous undertaking requiring the utilization of all the resources of the science of surveying and mapping. In Canada, the problem is accentuated on account of the vast territory rich in natural resources which is waiting to be accurately mapped as a prime requisite to its orderly and economical development and on account of the tremendous expansion into new fields of discovery in minerals, and the like, which is presently taking place. At the same time, the small population makes it difficult to provide sufficient funds for the prosecution of the mapping work." The foregoing statement also well describes the need for completing the mapping of the United States.

"Dealing with conditions in the past, the late Dr. E. Deville, Surveyor General of Canada, in writing the introduction to his well-known book on Photographic Surveying, in 1889, expressed himself as follows:—

"When the surveys of Dominion Lands were extended to the Rocky Mountains region, it was found that the methods hitherto employed were inadequate. . . . The proper administration of the country required a tolerably accurate map; means had to be found of executing it rapidly and at a moderate cost. The ordinary methods of topographical surveying were too slow and expensive for the purpose; rapid surveys based on a triangulation and on sketches were tried and proved ineffectual, then photography was resorted to and the results have been all that could be desired. The application of photography to surveying is as old as the art itself. Arago, in presenting Daguerre's discovery (in 1839) pointed out its application to surveying, but it was not until twenty-five years later that Laussedat gave in the *Memorial de l'Officier du Genie* a full exposition of the method. His work was so complete that little has been added to it since."

*COMMITTEE ON MUNICIPAL FIELD ENGINEERING, 1936

Walter Starkweather, Chm.	Washington, D. C.	H. M. Dibert	Troy, N. Y.
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"Mapping from the ground by photographic methods, as instituted by the late Dr. Deville, has been carried out more extensively in the Rocky Mountains of Canada than anywhere else in the world. The method employed in the mountains, well described by Bridgland in Bulletin No. 56, Photographic Surveying, of the Topographical Survey, is based upon triangulation control, the detail being obtained by photographs taken in a vertical plane from fixed camera stations by the use of an accurately levelled surveying camera, the true orientation of each photograph being obtained by means of an auxiliary transit."

The Topographical Survey of Canada is one of the leaders in the art of photographic mapping and has developed the theories of plotting oblique as well as vertical aerial photographs in their Bulletin No. 62. This bulletin also gives information on aerial survey cameras, ground control, mosaic mapping, base maps, and filing aerial photographs.

In the United States, there seems to be somewhat of a trend toward state and local use of plane coordinate systems based on nationally established geodetic positions, as evinced by the statutory adoption of coordinates for surveying and mapping by the state of New Jersey and a number of cities throughout the country, some of which have city ordinances making the use of the established system mandatory upon local field engineers and surveyors.

NATIONAL MAPPING

The U. S. Geological Survey had completed topographic maps for 47.1 per cent of the area of the entire country by June 30, 1936, the increment for the previous year being 0.4 per cent. If the same increment holds true for the year ending June 30, 1937, it will still require over 130 years at that rate to complete the topographic maps; and the maps of much of the area now completed are obsolete. This little increment of 0.4 per cent means about 10,500 square miles. However, approximately 7,550 square miles were re-surveyed in addition to this. The ground surveying entailed about 4,500 miles of spirit leveling, about 3,500 miles of transit traverse, and the occupation of 85 triangulation stations in the United States. The increase during the past year was less than that during the preceding year due to the fact that the Public Works allocation for topographic mapping was approaching exhaustion and the work had to be curtailed.

Since the autumn of 1933 the U. S. Geological Survey has been compiling a planimetric map of the entire Tennessee River drainage basin from aerial photographs taken with a multiple-lens camera. The area of the drainage basin is in excess of 40,000 square miles, and it is expected that the work of compiling will be completed during the current fiscal year. This is thought to be the largest single photogrammetric project as yet undertaken in the United States. The work is being done for the Tennessee Valley Authority and is financed by that organization.

The U. S. Coast and Geodetic Survey reports that during the fiscal year from June 30, 1935, to June 30, 1936, they completed 1,937 miles of first-order levels and 8,187 miles of second-order levels, making a total of 107,783 first-order and 155,651 second-order levels completed by that Survey at the beginning of the current fiscal year. Their triangulation amounted to 64,916 miles on June 30, 1935, and 67,000 miles on June 30, 1936.

Since March, 1934, the U. S. Coast and Geodetic Survey has issued oc-

casional bulletins of about 36 pages called the "Geodetic Letter," which are primarily intended for their field force, but cover many topics of interest to all field engineers. Issues of this bulletin may be obtained from the Survey upon request.

AERIAL SURVEYING

The many varied purposes for which maps made with the aid of aerial photography are being utilized have tended to spread aerial surveying to nearly every state in the country and to Alaska, Porto Rico and Hawaii during the past year. Talbert Abrams, President of the Abrams Aerial Survey Corporation, Lansing, Michigan, reports a marked increase in the general acceptance of photographic maps for tax purposes and municipal engineering as shown by the mapping of a large number of cities by this method.

The U. S. Soil Conservation Service, under the leadership of Marshall Wright, is making broad use of aerial mapping, and maps are on file in the Washington office which outline the extent of aerial surveying now going on.

Topographic base maps of 43 quadrangles and parts of quadrangles in Louisiana, a total area of 2,749 square miles, compiled from aerial photographs, were completed by the U. S. Geological Survey, and line map bases of 20 quadrangles and parts of others, 1,957 square miles, were constructed from aerial photographs, making a total compilation of topographic base maps and line map bases of 4,706 square miles. Commercial firms photographed for the Geological Survey 6,754 square miles, and 213 square miles were purchased.

The American Society of Photogrammetry, with headquarters at 724 Ninth Street, N. W., Washington, D. C., is publishing an attractive and instructive quarterly, "News Notes," of about 40 pages, which is available to members of the society at nominal charge. This publication touches all phases of this new science which is so closely linked with surveying because of the necessity of control points of established position and elevation.

A "Textbook on Mathematical Computations in Aerial Photogrammetry" has been published by Professor Earl Church. It contains all of the material originally included in the bulletins published by Syracuse University, completely revised and rewritten, and also much additional material. This book has 145 pages and deals with fundamental principles of surveying and mapping from aerial photographs, and the analytical method of computing survey data from precise photographic measurements. It contains several groups of problems with methods illustrated and with answers, suitable for practice or for classroom use, based on actual photographic measurements. It is believed that this is the first textbook on aerial photogrammetry in English.

INSTRUMENTS

The angle hand level, made by Walter Thorburn of Seattle, Washington, has a "vertical line projector" as a special feature attachment designed for use in forestry work, especially in locating the coverage area of the crown of a tree. The maker will send descriptive circulars on application.

The world's largest single unit multi-lens aerial mapping camera has been completed for the Coast and Geodetic Survey of the U. S. Department of Commerce by the Fairchild Aerial Camera Corporation, it was announced in January, 1936, by Sherman M. Fairchild, president of the Fairchild Aviation Corporation. This camera was designed for mapping from a higher altitude

than has ever before been practical with multi-lens equipment. From an altitude of 30,000 feet it will photograph an area of 600 square miles at one expanse. The camera has nine vertically mounted lenses, eight of which have associated steel mirrors of high reflectivity, weighs 305 pounds when loaded, stands 38 inches high, has a maximum diagonal cross-section of 35 inches, and has one large film for all lenses instead of a small individual film for each lens. The weight of the camera and accessories needed for a photographic flight totals 636 pounds. The shape of the camera is like no other ever built; it is unique in appearance, operation and performance. The nine-lens aerial camera was designed by Lieutenant O. S. Reading, of the Coast and Geodetic Survey, and by engineers of the Fairchild Aerial Camera Corporation.

A small contour finder with a micrometer adjustment with which the height of trees, buildings and hills can actually be measured on photographic maps has been developed by the Abrams Aerial Survey Corporation of Lansing, Michigan. This instrument weighs less than a pound and can be used with any standard universal drafting machine, planimeter or pantograph, thus increasing the usefulness of these instruments. Contours can be drafted directly and accurately on photographic maps with this contour finder which is completely collapsible and can be carried into the field on an extensive project.

EQUIPMENT

One of the most practical items concerning equipment of interest to field engineers and surveyors during the year is the use of ball bearings as turning points when accurate spirit leveling is being done along the line of a concrete pavement. There is an article on this subject indexed in the bibliography of this report under the heading "Leveling."

METHODS

Methods of routine field engineering and note keeping adopted by the Township of Lower Merion, Pa., as reported by the Township Engineer, Walter E. Rosengarten, are rather out of the ordinary. The township is a beautiful suburban community immediately west of Philadelphia, with an assessed value of \$86,000,000, and it is essential that every effort be made to retain the beauty of the landscape.

The way in which highway survey notes are kept has proved very successful. On the page to the right of the book all objects to be located are sketched, a ruled line down the middle of the page denoting the center line of the road being surveyed. Opposite each object its station and offset are noted. Well made notes of this type will practically take the place of a plan. The page on the left of the notebook is used for level data, every second parallel line covering a twenty-five foot interval along the center line of the road. At the even stations and the "plus fiftys" a cross section is taken. Elevations and offsets are noted in the book along the line representing the plus and to the left or right of a ruled center line. They are written as a fraction, the elevation above the line and offset below as $73.25/19.4'$. The recorder subtracts the rod reading from the instrument height in his head and notes only the elevations. A space is reserved at the extreme right of the page for the station and the new grade as determined after plotting the profile. At the bottom of the page "center line," "gutter line," "walk," "hedge," etc., are written directly below the column into which their elevations and offsets are written.

When the field notes have been plotted and the new improvements designed, it is usual practice to walk over the road and investigate in detail the effect of the new work on abutting property. It has been found that this eliminates many difficulties which would arise when work is in progress and changes almost impossible.

In staking out a project the usual practice is to place 1" x 2" x 24" oak stakes at fifty foot intervals on each side of the road several feet behind the curb line. On the edge facing the road is marked the station. On the left face the offset to the face of the curb from a nail in the top of the stake is shown, and on the opposite side the cut or fill from the top of the stake to the top of the curb is indicated.

For marking grade stakes a short cut is usually employed. As soon as the instrument is set up and its height determined, the new grades for the stations nearest the instrument are subtracted from the instrument height and the results noted on a piece of scrap paper. When the rod reading is taken on a stake it will be equal to, greater or less than the difference of the instrument height and the new grade. If they are equal the stake is necessarily on grade, if greater, it means a "fill," and if less, a "cut." The cut or fill is the difference and can be worked in the head. The advantages of this system are that the actual number of subtractions is cut in two and that in practice it is much more convenient to use in the field than the old system which requires an elevation for each stake.

Until a few years ago all roads, drains, sewers or structures were surveyed, using an individual level datum for each job usually designated as 100. About two years ago one hundred and fifty concrete bench mark monuments with bronze discs were placed in the Township. A network of levels is being run as opportunity permits, and it is expected that by the end of the year elevations will be available on all benches based on Sandy Hook Datum as brought into the Township by the Pennsylvania Railroad. This will make possible the tying together of all surveys, and assist materially in developing a topographic map of the Township which is needed.

INDEX OF ARTICLES AND BOOKS

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Manual of First-order Leveling. H. G. Avers, 93 p. U. S. Coast and Geodetic Survey, Washington, D. C., 1935.

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DISCUSSION

MR. H. E. BRYAN (Rochester, N. Y.): I have followed aerial surveying and mapping since 1921 and I have been very much disappointed with the application of aerial surveying and mapping to specific cases. I do not mean to take issue with the aerial mappers of a region, but when you apply it to small areas and on rather a large scale—for example, a scale of one inch equalling fifty feet—you will have to revert to the enlargement of the original negative. When you do that, even though you have perfect horizontal control, and even through triangulation there is distortion from your original picture; even when you come to the last step of taking it over from your enlargement and reducing it from that to the final scale, you will find you cannot make accurate locations no matter what the aerial photographers say.

I have tried it and resorted to all mathematical procedures I know, and with the best of improved methods that have been set forth. However, we plotted a river with absolute control on the ground and on the map, so that the points on the negative could be correlated exactly to the points on the finished map. Then we carried it through a series of enlargements and found that due to aberration both in the lens and the contact negative, and in the enlarging apparatus, the results were anything but satisfactory.

The second instance I want to speak of is a case of taking topography from one of the government charts where the ground map was prepared by an aerial survey. In that case the final map was being prepared to a scale of one inch for a hundred feet and we had positive and accurate location of the distinguishing figures. There again when we tried to take off the contour lines from the government map which had been located on the base map by use of aerial photography of that region, we ran into much difficulty due to that same cause, and the contour lines that we might have put on our map at the scale of one inch for one hundred feet would have been so inaccurate as to have been worthless.

I am very much interested in the paper and very much interested in the articles on this subject, but please do not throw away your level rods or instruments yet as the articles would indicate that you should. However, for a general picture of a large area there is no doubt about the method's being much faster than the regular engineering method.

MR. HARRY EUSTANCE (Ithaca, N. Y.): The City of Ithaca has adopted the use of aerial maps that have met with great public approval. We have a map book showing on a hundred-foot scale all the built-up sections of the city and we get exclamations of astonishment from the people who come in with a problem and we turn to a certain scale photograph of that area, and they are very well pleased to see how their property looks and how the intersection looks, and in that way it is very easy to answer their questions.

BETTER STREET LIGHTING FOR TRAFFIC SAFETY

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Chairman of and Reporting for the Committee on Street and Traffic Lighting*

DURING 1935 a growing consciousness of the need for accident elimination on our streets and highways has brought about a more thorough analysis of the requirements for improved public safety. Noteworthy in the growing trend toward concerted action has been the recognition of accelerated night accident losses as compared with both the day and overall accident trends.

So serious has the night accident situation become that in many localities statistics reveal that two-thirds of all the fatal and serious accidents are resulting from the small fraction of one-fifth of the total traffic which is making use of our public thoroughfares during the hours of dusk and darkness. An early clew for the remedy to this situation may be found in the Interstate Commerce Commission reports on railroad crossing accidents where it is found that in over half of the night crossing accidents, the automobile is actually driven into the side of the train, rather than the train running into the automobile.

This may sound like "Man Bites Dog" news, but it is nevertheless true that motorists would not deliberately run down trains if existing visibility conditions assured adequate stopping distances with the necessary margin of safety for such unexpected conditions as slippery road surfaces, locked brakes, driving distractions or the many other numerous causes of America's terrific accident toll.

Visibility as a factor in traffic safety differs from all others in that it possesses the inevitable and constant element of change. It is not limited to the conditions of a particular corner, to the number of traffic lanes, or the many other factors with which traffic engineers are usually concerned. It is in effect an overall factor, the significance of which is indicated by the fact that daytime accidents have in general been on the decline over a period of several years during which traffic volumes have actually increased. Contrasted with the rapidly increasing trend of night accidents, however, the need for improved lighting is readily appreciated as a protector of human life and property.

With several years of curtailed budgets for lighting reflected in the loss of no less than 8,000 lives, fifty being reported in the city of Detroit alone for one year, city and state officials entrusted with the responsibility for providing sound public works are fast proceeding with the rehabilitation of curtailed and obsolete lighting facilities.

If public acceptance is given to the expansion of such rehabilitation programs,

*COMMITTEE ON STREET AND TRAFFIC LIGHTING, 1936

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Mr. S. C. Lovett	<i>Pittsburgh, Pa.</i>	Kirk M. Reid	<i>Cleveland, O.</i>
Theodore M. Matson	<i>Philadelphia, Pa.</i>	Thomas W. Rolph	<i>Newark, O.</i>
	L. A. S. Wood		<i>Cleveland, O.</i>

permitting all obsolete lighting to be displaced in conformity with the Illuminating Engineering Society code for adequate street illumination, it is reasonable to expect that about 3,500 lives would be saved annually in the cities of the United States. Twice as many more lives would be saved if the major traffic arteries between cities were provided with suitable types of highway lighting, as has been shown by accident experience where proper comparisons of adequate illumination have been made with existing visibility conditions.

Recognizing the saving not only in large intangible losses from the extracted toll of human life and suffering, but in the costly thousands upon thousands of dollars in hospitalization, property damage, wage losses, and excessive insurance costs, many cities have this year installed new types of lighting equipment which provide substantially increased levels of illumination at reduced operating costs. In one county alone in the state of New York, twenty-two miles of new highway lighting were dedicated this month and experimental installations are under process of construction in a dozen more states.

Commendable as the current trend for improved lighting may be, there are still many cities in which street lighting is not up to the standard required for modern traffic conditions. In addition, there is still a great majority of the states in which expenditures for highway lighting cannot legally be made. Public works officials in these locations are undoubtedly anxious to initiate lighting projects which will return the same favorable results as the newly completed installations which have been reported.

The principal deficiency, however, seems to lie in the apparent need of a more concerted public demand for improved lighting. This may to some extent have developed from past impressions that street lighting was intended to serve only an ornamental purpose. Such impressions will be rapidly erased, however, with the growing knowledge of the crime and accident protection value of adequate illumination. To serve this purpose, and thereby help public works officials in emphasizing the need for lighting rehabilitation which will lessen night traffic hazards, organizations interested in the promotion of safety are making numerous means available for stimulating the proper public education on safety requirements.

Recommendations and programs are being suggested, numerous forms of publicity are being initiated, and means have been provided for demonstrating the hidden element in safety which is perhaps better known as "reaction time." Noteworthy among these methods of public education has been the development of the "Accident Meter," a device for demonstrating the rate of accidents and the economic losses which they create. When operated at present accident frequencies, which are actually taking a greater toll of American life than did the World War, the demonstration of accident experience is almost unbelievable.

Obviously the three essential requirements for improved safety are careful drivers, safe cars, and safe thoroughfares throughout the full twenty-four hours of the day and during the entire life of both vehicles and roads. The "Accident Meter" display contains a complete pictorial demonstration of this approach to safety and has been one of the most successful means of securing concerted action in local safety campaigns.

Since the problem of visibility as an adjunct of safety is probably the least understood, because seeing is so often taken for granted, the "Traffic Safety

Analyzer" has been developed to supplement the story told by the "Accident Meter" through a practical demonstration of the deficiency in prevailing visibility conditions, together with methods for employing illumination more effectively in the elimination of night accident hazards. Demonstrations which thus afford the means for crystallizing public opinion on the importance of progressive works undertakings will not only be helpful to governmental officials, but will bring about improved social standards which cannot fail to reflect commendation to administrative groups large and small.

The past year has seen many other accomplishments, many of them related to the field of illumination and public safety. Such developments which should not be overlooked by public works officials in planning their new projects include improved equipments for utilizing the increasing number of light sources available as tools for accident prevention. Sodium light sources are increasing in popularity for rural highway illumination and the continued trend of improvements in mercury vapor lighting have given assurance to its becoming one of the most prominent sources for producing future street illumination.

Of outstanding importance in all the newer types of street and highway lighting equipments has been the improvement in utilization of light to more economically obtain higher levels of illumination. Concurrent with this and of equally great importance is the general trend toward glare reduction by the use of shielding devices, which will in general permit satisfactory practice without increasing mounting heights even though larger light sources are used.

In some of the equipments shielding is accomplished entirely by the relation of the light source with the equipment housing, whereas in other types auxiliary means for shielding are provided within the customary enclosing globe which serves the additional purpose of concealing them. Additional light controlling methods of importance are being obtained by incorporating refracting surfaces on the inner wall of the enclosing globe, thus eliminating the necessity for an auxiliary piece of glassware. Lighter weight fixtures of more simple design appearance are increasing in popularity and most of them are made to accommodate all of the principal light sources, excepting sodium which is being confined exclusively to highway lighting service.

Progress in public safety is certain to create extensive rehabilitation and expansion in all phases of public lighting during the next few years. Night traffic hazards will be overcome so that motoring at night will be even more pleasant than in the daytime, due to the absence of sunlight glare. Such improved conditions will be brought about by a better understanding and wider public consciousness that lighting is indispensable to safety. Cognizant of these facts, and of their vital relation with the field of traffic safety, the illumination profession is ready to shoulder its responsibility and with the co-operation of public works officials greatly improved standards of illumination are assured.

DISCUSSION

MR. S. C. LOVETT (Pittsburgh, Pa.): In Pittsburgh we had rather an unusual condition. For upwards of twenty years the lighting company had been supplying the city with light at a cost amounting to approximately twenty thousand dollars a year on an average, and some of that lighting was not as

well conceived nor nearly as well designed as it should have been. About two and one half years ago I was engaged to take over the lighting of the city of Pittsburgh. I found at that time that we needed on the basis of the lighting conditions on the street surface—that is all I am interested in, I don't care about lighting trees—in the neighborhood of thirty or forty thousand dollars a year to accomplish what we wanted in the way of street lighting, to try to combat the terrific toll that we were paying there in the form of hospitalization and death. We were killing, and had been for a number of years, from one hundred to one hundred and forty people a year on our streets.

I had only a very limited budget to work with, but with an increase of seven thousand dollars a year we have put on a quarter of a million additional candle power on our streets. I don't know if that is put to you so that you get the story, but, for example, we had street lights with mountings at the height of twenty-three feet. By moving those lights down to eighteen feet we tremendously increased the light density. We have lighted approximately fifteen miles of street in Pittsburgh in the last two and one half years. And, the average increase in the budget during that period has been approximately seven thousand dollars per year.

Now, we work out very closely all of these details with our traffic planning commission. Mr. Burton W. Marsh, whose paper you have heard, was for years a very close friend of mine and was in Pittsburgh in charge of our Traffic Planning Division.

Another thing I would like to get comments on is the very important subject of negligent accidents on the street. This is a bit out of my line, Mr. Chairman, but I would like to have somebody express an opinion on how to handle such cases as this. We have on file over one hundred and fifty suits against the city of Pittsburgh right now. Mr. Shafer who has charge of Highways and Sewers is aware of this condition too. If somebody comes along and takes out a step from one of the numerous steps we have in our walks up the side of a hill (and we have approximately fifty miles of them in the city), and then if the next person comes along and falls, he immediately starts a suit. Suits last year cost the city somewhat over a hundred thousand dollars, and at the rate it is going this year it will be about one hundred and twenty thousand dollars, unless there is a good fat one that comes in. Now, I am wondering if you are all faced with that type of a suit and how you handle it.

I have testified in, I believe, eight cases in the last two weeks for the city as to lighting intensity requirements. It is a very difficult problem, so if you have anything to offer, I think it is well worth discussing what you consider the necessary intensity of illumination for adequate visibility.

MR. GUY BROWN (St. Louis, Mo.): Mr. Lovett concluded his remarks with the statement that they kill about one hundred and fifty a year on the streets in Pittsburgh. I was wondering whether that analysis had been made to show how many of those had been killed during the day when poor lighting was not the reason for it.

MR. LOVETT: It ran approximately forty-five per cent at night and fifty-five per cent during the day. Of course, we have a lot of hills there and very heavy traffic, and that is why we raised our intensity of illumination.

MR. BROWN: I know that some cities have more accidents in the daytime

than they do at night, and it is hard to attribute that to poor lighting.

MR. LOVETT: Mr. McNeill, who is in charge of traffic in Pittsburgh, is a personal friend of mine and we work very closely together. In laying out our street lighting we make an extensive analysis of traffic conditions on the street. As a rule we go back five years and take the number of accidents and the number of deaths that have occurred in a certain area. I don't think that any of the hospitalization figures amount to very much, but we analyze conditions on a street to find out the density of traffic and the general street condition, and then we put in our budget what we need in the way of funds to rectify the difficulty. I don't know whether this statement is one hundred per cent correct, but I understand that last year I was the only one in the City of Pittsburgh whose budget record showed that I was given more money than I asked for.

MR. FREDERICK T. PAUL (Minneapolis, Minn.): What is the candle power intensity between lights?

MR. LOVETT: Let me answer that in this way: The Illuminating Engineering Society, which is the yardstick by which a good many of our street lighting problems have been solved, has set up certain standards, but these standards are so flexible that they are perfectly useless. For instance, they recommend a mounting of thirty feet for one standard and then for another they recommend a mounting of eighteen feet. Standards so widely varied you can see are not of much value. However, to answer the question, I would say on the medium traffic street we have employed a standard of about sixty per linear foot, that is on the assumption of a mounting height of twenty feet. That is the limitation we have put on our standard. They are all based on a twenty foot mounting.

MR. S. SHUPE (Kitchener, Ont.): I would like to know if with the lower light you are bothered with tree limbs. Do you have any trouble with the trimming of trees in the residential district?

MR. LOVETT: We have a trimming ordinance in Pittsburgh that permits us to trim any tree to a height of ten feet, and with the Sycamore trees it is quite a problem.

Illumination curves of most street lighting fixtures are based on a standard of ten degrees below the horizontal. If you project from mountings at the height of eighteen or twenty feet out your maximum illumination at ten degrees below the horizontal, you will find that at a distance of roughly seventy-five feet from the lamp, assuming it is a six hundred candle power lamp, your illumination is getting down to such a fine point that it amounts to I believe between fifteen one thousandths or twenty one thousandths of a foot candle. So you see then you are getting down to a point where it is not even silhouette lighting, and nothing more or less than a very timid and very mild shadow.

Incidentally there is an illumination chart put out by one of the large companies which shows glare effect—which is something also to be considered. The figures generally show that glare, after a mounting height of sixteen or seventeen feet, is more or less a negligible factor, because it apparently is so much out of the ordinary range of vision as not to be undesirable.

MR. A. E. ROCHE (Troy, N. Y.): I think the gentleman from Pittsburgh should tie up that subject in some way with the subject of traffic control and traffic safety. It comes back to just what we discussed under the heading of "Engineers' Interest in Traffic Control." Now this gentleman from Pittsburgh

is intensifying the illumination on the public streets for the purpose of traffic control and traffic safety. So, I reiterate that it behooves the engineering profession to deal with this problem in an intensive manner.

MR. LOVETT: I happened to be in Cleveland about a year and a half ago and I walked into an engineering meeting of the National Safety Council. One of the men asked me if I would take charge of it and conduct the discussion, and the meeting lasted for about four hours. We went into all sorts of ramifications. And, in answer to Mr. Roche's remarks, I would like to say that in Pittsburgh we are running our own business and putting the lights and the posts where they will do the most good.

MR. P. L. BROCKWAY (Wichita, Kan.): It seems to me that I might very well complete the discussion and bring it back to where it started, for everything you have been discussing leads back to city planning. Now, before you know how, where, and how much lighting, etc., you must have some idea as to where your traffic is, and you have to do some planning. You can't get away from it. Everything comes back to a comprehensive plan of all the functions of the city and then you have the answer to the whole business.

INTEREST OF ENGINEERS IN TRAFFIC CONTROL

BURTON W. MARSH

American Automobile Association, Washington, D. C.

Chairman of and Reporting for the Committee on Traffic Control *

AS A GROUP, engineers still are apparently very little interested in the traffic problem and what the engineers can do about it.

Perhaps that isn't a fair statement. Probably most engineers believe that they do not have time to devote to this new, though mighty important, field of traffic engineering. Unfortunately, the failure of many engineers to devote the necessary time and energy to the study of traffic problems and engineering approaches and solutions has produced bad results.

One, for example, is that even today many an engineer is actually creating future traffic problems merely because his whole attention is being given to stresses and strains, wear and maintenance of the materials involved, and practically none to the use of the facilities which he is creating and to the proper design to provide for maximum effectiveness.

The Committee on Traffic Control has recognized for the past four years that its major job was to interest the engineering profession in this vital and important subject and in what they can do about it.

It decided this year to find out just what progress it was making and what attention was being given to the reports. A one-page inquiry form was sent to 262 members of the two associations. These persons were selected as being those most likely to be interested in traffic control. The inquiry read as follows:

Inquiry: Report of the Committee on Traffic Control, entitled "First Engineering Steps to Improve the Traffic Situation," beginning on page 142 of *Public Works Engineers' Yearbook*, 1936.

1. Which of the 14 numbered suggestions have you been able to put to practical use and with what results? Please list by number of suggestions.

2. Which of the 14 suggestions does your community still need to carry out? (Give by numbers.)

3. What traffic subject would you like this year's report of the Committee on Traffic Control to cover?

4. I have reviewed the following reports of the Committee on Traffic Control:

a. "Solution of Traffic Problems a New Engineering Responsibility"

—Yes No—

(Vol. 38 of the *Proceedings of the American Society of Municipal Engineers*, 1932-33, pp. 161-177)

b. "How the Engineer Can Help Reduce Traffic Costs" —Yes No—

(Vol. 39 of the *Proceedings of the American Society of Municipal Engineers*, 1933-34, pp. 124-143)

*COMMITTEE ON TRAFFIC CONTROL, 1936

Burton W. Marsh, Chm	Washington, D. C.	Frank J. McDevitt	St. Louis, Mo.
Maxwell Halsey	Cambridge, Mass.	Theodore M. Matson	Cambridge, Mass.
F. M. Kreml	Evanston, Ill.	Robert A. Mitchell	Philadelphia, Pa.
T. Keith Legare	Columbia, S. C.	A. J. Naquin	New Orleans, La.
Earl J. Reeder	Chicago, Ill.		

- c. "Nuisance Traffic Signals" —Yes No—
 (*Yearbook and Proceedings*, 1934-35, pp. 165-169)
 d. "First Engineering Steps to Improve the Traffic Situation" —Yes No—
 (*Public Works Engineers' Yearbook*, 1936, pp. 142-156)

The response would seem to bear out the indictment, if such it be, set forth in the first statement of this report, for there were only 25 replies received. A return addressed envelope was included and we indicated in the brief accompanying letter that ten minutes should be adequate to fill out the form, provided, of course, they had read the committee's report. Even if the member had not read the report, it would not have taken very long to scan its sub-headings and fill out the form.

As would be expected, those who by virtue of their position were active in the traffic field were frequently found among the persons replying. The analysis of replies, meager though they were, provided some indications which may be of interest.

Road marking, physical improvements, signs and signals had been given the most attention from the fourteen numbered suggestions in last year's report. The next most prominent item was conducting a traffic survey.

The suggestions in which the cities represented by the replies had shown the least interest were: (1) Conduct an analysis of accidents; (2) Make an analysis of the city budget to bring out the proportion of money used for traffic control as compared, for example, with the budget for fire prevention and control; and (3) Make before and after studies to indicate what results had been obtained by traffic improvement measures instituted.

Particularly significant is the lack of interest in the use of accident records. Here is a logical engineering type of activity of fundamental importance, yet very little is being done about it in many communities.

Analysis of such replies to the second question as were received gives a few indications which may be of interest. The suggestion most frequently mentioned as still needing attention was "Plan for improved routings for through traffic." The next most frequently mentioned was "Make an analysis of the city budget to bring out the proportion which is set aside for traffic safety, and safe use of the highways as compared, for example, to the budget to fire prevention and control."

It is significant to note that all the fourteen items listed in last year's report were mentioned at least once as still needing to be done by at least one person responding. Apparently, therefore, last year's report contains much that should be of value to such engineers as do become interested.

Encouraging is the indication that apparently most communities have secured a copy of the *Manual on Uniform Traffic Control Devices* and hence presumably are having their new signs, signals and markings made in conformity with national standards.

What traffic subject would you like your committee to cover? To this third question, the variety of subjects listed by those replying is interesting and in some ways surprising. For example, one would expect that engineers would prefer committee reports dealing with those phases of the problem closely related to engineering. Analysis of the subjects given below will indicate to a considerable degree that such is not the case.

An attempt to group the subjects mentioned was difficult, though several did deal with one phase or another of enforcement and that was the principal

subject mentioned in the replies. The next subjects related to one or another phase of highway design. Even considering the small number of replies, it was surprising that there were not more cases in which the same subject was requested by different persons. The subjects indicated were as follows:

Reducing speed; fining law breakers with jail sentence, revoking license.

Exterminating the road hog and horn-tooter.

The nuisance of the loud horn.

Some method of reporting traffic violations when a policeman is not there.

Method of obtaining more adequate enforcement of existing regulations.

Highway design standards for high speed operation.

Planning of streets and highways.

Safety zones; channelization islands.

A thorough yet simple explanation of how to time traffic signals under a variety of circumstances.

Regulation of speed in municipalities.

Should *prima facie* speeds be less for night driving?

Parking rules and regulations and parking facilities.

Use of parking meter devices, *i. e.* actual operating installations, price paid and results obtained.

The adoption of uniform traffic rules throughout the United States and removal of the confusion caused by different rules in each community.

Ordinance covering successful rules for traffic control that could be applied in uniform manner over state and nation.

Accomplishments in the way of reduction in the number of traffic accidents and traffic fatalities by those cities which have conscientiously tried to lower their death and accident rate.

Effect on traffic control of transition from street car to trolley bus.

Taxicab cruising and control.

The pedestrian problem; in the city, and in the country.

A concise and practical method of educating drivers and pedestrians in their duties and responsibilities for the reduction of accidents.

Convincing drivers that they have a personal responsibility and should drive with care and courtesy.

One of the very interesting requests was for discussion of the question as to whether *prima facie* speeds should be less for night driving. Analysis of the requests indicates in a quite outstanding way the lack of familiarity of engineers with the data, reports, and papers which are available on quite a number of subjects mentioned.

As a result of this analysis it is concluded that one obvious need is that something different be done to increase the interest of the members of these two groups in the traffic field. One effective way to gain interest is to get persons to do something about a subject. If the association had more local chapters and there could be developed discussions of the previous reports of the Committee on Traffic Control and of what the Committee's work should be in the future, it would be very helpful.

If some live issue dealing with traffic were to be put before the joint membership, it might produce enough reaction to warrant further study or reports. Generally, engineers are overburdened with inquiries or questionnaires and this would probably not be a popular way of attracting their interest. Reporting of progress in the field of traffic and traffic control would seem to be

better provided for in other ways than through an annual committee report. The Committee would appreciate a consideration of its future activities by a Board of Direction or Executive Committee of the associations in the hope that suggestions on how to be more effective in increasing the interest of engineers in this important field may be developed.

DISCUSSION

MR. A. E. ROCHE (Troy, N. Y.): At these meetings from year to year I have heard discussion of the cost of cleaning streets, the cost of regulating streets, the cost of widening streets, and other material factors that enter into street regulation, and yet this municipal group apparently has failed to take hold of a problem which is as expensive in the conduct of municipal affairs today as any problem which we are to face. There is not an engineering publication that does not deal to some degree with the cost of traffic control, and the necessity of traffic control. That subject has become so pertinent in our universities and technical schools that at Harvard last year they conducted a course of training in traffic control. They circularized many municipalities and invited the municipal engineers to attend the University for a six or eight weeks' training course in that subject. Among the limitations they put on was the age limitation of thirty-five years. I would like to have attended that course, but I could not get under the age limit.

It means that we who are now in municipal government, we who are now faced with the subject of traffic control, are in a day where we are not fully realizing the problems that we have to handle in the next few years. It means that we who are on the site and should be planning the traffic control regulations of our municipality are going to be supplanted by new and younger engineers who have studied that subject, and it occurs to me that our universities and polytechnic schools are going to give in the next few years courses of training and instruction in that very costly matter of municipal regulations brought about by the universal use of the automobile.

So, Mr. Chairman, it disturbs me a little bit, having served in municipal governments for so long, to see that there is not a greater interest in this subject on the part of us who are charged with the responsibility of conducting the public works affairs of our municipalities, and it disturbs me that we have not taken a leading interest in this subject as a group. I for one, Mr. Chairman, believe that we should not necessarily follow in any courses that universities and polytechnic schools will initiate, but that we now who are on the field and who are presumed to know something about traffic regulations, should be the leaders in the field and begin to point out the way to the universities and to those who are going to succeed us in the course of a few years. We should tell them how to handle this difficult problem which every municipality is facing.

MR. H. E. BRYAN (Rochester, N. Y.): I think the answer to a number of those points is the fact that in municipal governments the problem of traffic regulations and control seems to be usurped by the Department of Public Safety rather than the Department of Engineering, and if and when that function is rightfully transferred to the engineer, then the engineer will give it the consideration it should have. I think engineers have not considered to a greater extent the problems of traffic control—which are certainly engineer-

ing problems and I believe can be handled better by engineers than police officials—because in probably ninety-five per cent of the cities that function rests entirely with the Department of Public Safety rather than the Department of Public Works or the Department of Engineering.

MR. ROCHE: It was my happy privilege to attend a meeting of the Chiefs of Police of the State of New York at their annual convention and to talk to them on the subject of cooperation between police and public works departments. Before I had a chance to speak upon the subject assigned to me I found that their principal discussion had centered around the point of traffic regulations and that the Department of Public Safety of the municipal government was handling that exclusively.

Now, the Department of Public Safety in most municipal governments is conducted, I might say, by laymen. The engineer has failed to take on to himself in his Engineering Department that subject which rightfully belongs to him, and his neglect to have taken it up has placed it in the Department of Public Safety, which department is not as well equipped to handle it as the Department of Public Works through its engineering force. If there is not some well-directed force in the Department of Public Works or the Engineering Department of your city which is ready and willing to take up the subject of traffic control, you will find that the Department of Public Safety will have usurped the entire control of it and that they in turn will call in some small measure on the Bureau of Engineers of the municipal government to help out, perhaps in the location of signals, perhaps in the counting of traffic, or perhaps in some of the minor details pertaining to this very important problem. I think it behooves every Director of Public Works and every City Engineer to begin to give some immediate thought to whether or not the regulation of traffic is going to rest in his department or whether it is going to rest in the Department of Public Safety. The problem is so filled with ramifications and lends itself so readily to enlargement and importance that I don't believe it should be neglected.

MR. CHAIRMAN, I commend to each of the City Engineers to write to Roy C. Finch who is Executive Engineer of the New York State Highway Survey Committee to secure from that gentleman a copy of his last report which has been made by the New York State Highway Survey Legislative Committee. You will find that report filled with data which pertains to the engineering subject of highway control which should in turn be absorbed by the City Engineer, enlarged upon, and made useful to his interest in serving his own municipality.

MR. WILLIAM GALLIGAN (Chicago, Ill.): I know that in Chicago traffic control is in charge of a Traffic Engineer who is in the Department of Public Works, and under the jurisdiction of the Commissioner of Public Works, and I thought that was universally true because it is the same in all of the large cities.

MR. G. E. HESSELBACHER (Elkins Park, Pa.): Coming into Toronto by auto yesterday I saw one sign that said speed limit thirty miles per hour; the next village said speed limit twenty-five miles, and then the next one twenty miles. I mention that to bring out the important point that we should have uniform regulations, uniform laws, and the education of the people to those uniform laws and regulations. Perhaps we are all sinners when it comes to traffic regulations, but every citizen is an officer of the law. You may not be

able to grab somebody by the back of the collar and haul him in, but it is easy enough for you to take his license number and turn it in to the police station. The execution of that procedure is a bit tedious and distasteful because, as I say, most all of us do violate some regulations sooner or later, but it can be done if we will all take the time. If we only had uniform regulations and laws so the people traveling about the country would know what to do in New York or Kansas City, or Canada, or in my home town in Pennsylvania where rules and regulations change over night, it would be a great help.

MR. HARRY EUSTANCE (Ithaca, N. Y.): I believe that the reason Mr. Marsh did not get more answers to the questionnaire was because it was so hard to answer. In the first place it called for a knowledge of the previous report of the Committee and to inform yourself you had to consult the 1936 Yearbook, which a lot of us did because we wanted to be cooperative and answer the questionnaire. Then in studying that report in the Yearbook we found a lot of items that were almost impossible to answer with direct "yes" or "no." I imagine that was the experience of many other members and they finally gave it up and said, "I am sorry we can't help the committee but it is altogether too much work."

I think engineers are very much interested in the question and I am sorry that the Committee feels that they are not because they did not respond to the questionnaire.

MR. SAMUEL S. BAXTER (Philadelphia, Pa.): Philadelphia's experience more or less bears out Mr. Bryan's comments. The traffic engineer's office was established there ten years ago and placed under the Department of Public Safety. Then in line with the thought that it was a public works function it was transferred to the Public Works Department. This past year mainly at the instance of public associations, automobile clubs, etc., it has been transferred back to the Department of Public Safety.

The organization in the traffic engineer's office is exactly the same in the Safety Department as it was in the Public Works Department. In fact they have fewer resources there because they do not have the public works engineers to call upon.

Just one more thing. I think probably the engineers' attention to traffic is not as light as it seems. Traffic is just one function of road design after all, and while we may be behind in traffic control on existing roads, I am sure that anyone of us who lays down a new road takes into consideration the capacity of that road for the number of cars it is supposed to bear, just as we design a pavement for the amount of traffic to run over it.

MR. W. W. DEBERARD (Chicago, Ill.): I think the last gentleman has indicated that there is probably more interest in the subject on the part of engineers than appears on the surface. This body has given up space in its program time and time again for the last five or six years to the presentation of very long papers by Mr. Marsh, Mr. Halsey, and our Committee on this particular subject and the papers are filled with some very well-known names. I know of no organization that can command the character of the names we have on that Committee, which has certainly done a lot of very good work in the past. However, I think it has gotten pretty high brow, and has gone a little too much into detail.

Traffic engineering has become quite an accomplished and exacting science in the minds of those who have given it a lot of study. I think each of us is

cognizant of the fact that it is distinctly an engineering problem. As Mr. Marsh said in his original report, the basic principles are of engineering origin. That is to say, you have to start with the traffic survey and find out what your capacity is. Then the whole build-up is an engineering proposition and has nothing to do with police operation and police regulation after the street is built. It occurred to me as I listened that this is very much a research problem. It seems to me this traffic proposition is one which our united organizations could very well spend a lot of good brain energy upon, in developing a research project that would have far-reaching results. I will not attempt to indicate what the research should go into, but you all know that there are many questions with reference to whether a street should be thirty feet wide or forty feet wide, what the capacity should be, and various other phases of street design.

Mr. Brockway wrote a paper five or six years ago in which he described the various phases of street design. Now, street design is the basis of capacity, and the ultimate use of that street by vehicular traffic is something that we as engineers certainly ought to be looking into. We do not stop at today's needs if we are going to build a sewage or water plant. We always plan for ten, fifteen, or twenty years, depending upon the structure. The highways are built for twenty years, or if the brick pavement people are talking to you they will say forty years, the concrete man will say something like that, and the asphalt man will not be far behind. So, I think we have a definite challenge to get busy on research on the traffic problem from an engineering standpoint.

MR. W. E. ROSENGARTEN (Ardmore, Pa.): There has been some discussion as to whether this is a matter of Public Safety or Public Works. It seems to me the question of traffic is one of cause and effect, and possibly the Public Safety Department is more interested in the effect or results from the regulations of traffic than the Public Works Department, while the Public Works Department is more interested in studying the causes and trying to eliminate them. Therefore, I see no reason why it should be regarded as one hundred per cent Public Works or one hundred per cent Public Safety. Rather, it is a problem that requires joint and cooperative work to solve properly.

A second thought I wanted to mention was the fact that the Philadelphia Chapter of the organization has for its program in October the problems of traffic, so that the local chapter is giving very careful thought to this subject.

And, as a last thought on the Committee's report you will note that it closes with the heading, "What traffic subject would you like your Committee to cover?" Possibly it would be of interest if, after we get our Proceedings of this conference, we would write the chairman of the Committee which of the long list of subjects included in their report we are most interested in.

MR. FREDERICK T. PAUL (Minneapolis, Minn.): I just wanted to say that in Minneapolis we have been very successful in joining hands with the Police Department. As a matter of fact the Captain of the police in charge of traffic makes his headquarters in the traffic engineer's office most of the time, and all matters of design are handled by the traffic engineer.

I think the biggest problem we have—even larger than research or study—is finances. I don't think there are many engineering departments in the larger cities that are not capable of properly designing roads or adequately handling the traffic question if somebody will furnish the money with which to do it.

MR. W. B. SHAFER (Pittsburgh, Pa.): I would like to mention the coopera-

tion between the Bureau of Traffic Control and the Highway Department in Pittsburgh. Last year, as all years, we were faced with the tremendous problem of icy streets, which it had been the function of the Bureau of Highways to take care of. We have a very large percentage of steep hillsides, and it is a distinct hazard to use them. We conceived the idea of working out a plan between the Bureau of Traffic and the Highway Department. We formulated a definite schedule of all the worst intersections and where the traffic hazard was greatest, and we put that into a definite program so that the minute there was any indication through the weather bureau that a slippery condition would exist, we immediately, and according to schedule, set out to take care of these definite places. The Traffic Control Department cooperated with us by first sending out a radio broadcast warning the public of the condition that probably would exist either in the early morning or in the late afternoon; then they kept in constant twenty-four hour touch with our bureau through their radio cars. Through their central office they communicated with our various divisions and reported conditions that possibly we had not touched. The result has been that we have reduced the accidents I would say fifty per cent through the cooperation of the two departments.

We are trying now to continue that cooperation in other fields, but I think cooperation is the answer whether it is under the Department of Public Safety or the Department of Public Works.

MR. A. E. ROCHE (Troy, N.-Y.): I believe our executive director should inform the chairman of this Committee who presented this paper that there has been a great deal of interest shown so that he will be encouraged to go ahead in his important study on the traffic control problem.

TRAINING FOR PUBLIC SERVICE

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THIS discussion is an attempt to deal with the problem of formalized training for public service, with particular emphasis on the place that engineering training takes in the whole program. The term "public service" in this case will mean employment by federal, state, county, municipal, or other recognized public authorities.

Those who have positions in this field may, broadly speaking, be classed in two groups—technical and nontechnical. The former includes definite professional work, such as law, medicine, engineering, accounting, etc., and the latter includes those positions for which professional training is not prerequisite. This paper will deal principally with the educational program for engineering students who have careers in public service as their objectives.

In a recent article entitled "The Engineer in Government Service," General Markham, Chief of Engineers, U. S. Army, states:—"More engineers are now employed by the Government than at any time in its history; and still more are coming into frequent and intimate contact with Government bureaus and agencies."

This observation is supported by the first release of data from the survey of the engineering profession conducted by the U. S. Bureau of Labor Statistics. This report classifies the occupations of about 35,000 engineers who replied to its questionnaire and of this number 31.5 per cent are found in the field of public service. According to this survey 63.3 per cent of the civil engineers were employed by governmental agencies, the next highest being agricultural and architectural engineers with 51.5 and 40.3 per cent respectively, reported as so employed.

Less than 10 per cent of mechanical, electrical and chemical engineers were found in public service, the predominant field of activity for these engineers being in manufacturing except for electrical engineers, a larger number of whom were shown to be identified with public utilities. Relatively, there has always been a large number of civil engineering graduates who found their way into public positions of some sort and the widening scope of governmental activities in recent years has increased this number. At Syracuse University, our records show that 70 per cent of the students who were graduated in civil engineering in the last three years are now in the field of public service. This proportion is probably typical of the graduates of other schools.

On this account, this discussion has the civil engineering curriculum chiefly in mind, in connection with possible modifications and changes to take into account the fact that such a large proportion of these graduates enter public service.

As specific training of engineering students for public service is a fairly new idea, I felt it would be helpful and authoritative to get the opinions of a number of our graduates in civil engineering who are now actively engaged in federal, state and county positions. Accordingly, I presented the question to a number of our older graduates, selecting those who are in administrative or executive positions, and some of their comments will be referred to later.

Some general notion of his professional career is usually in the mind of the student when he begins his college course in engineering. However, despite the fact that most engineering colleges have a common freshman year, making it possible to defer the selection of the degree course until the end of the first year in college, it is doubtful whether many of those who survive the initial year make any change in their first choice.

When it comes, however, to the more definite consideration of the specific career within the branch of engineering selected, it is doubtful whether many of the students in their years in college as undergraduates have more than the vaguest notions about their prospective employers or the type of work in which they will be engaged.

This view is expressed by one of our graduates located in San Francisco, who writes me as follows:

"From my experience, I believe that comparatively few students entering an engineering college can be sure just which branch of civil engineering they will ultimately follow. This was true in my case, for originally I had a strong preference for railroad work and really did not give this up entirely until after graduation. From my observations, other engineers have had a similar experience. With conditions changing so rapidly now, I believe there is even greater chance of one changing his ideas while in college or later."

However, even assuming that the student when he enters college is definitely committed to a career in public service, it will not be an easy matter to modify his formal undergraduate program of studies that are in the engineering curriculum, few of which, engineering graduates, themselves, would be in favor of omitting. For example, an executive who has been out of college over 20 years remarks:

"There were no courses in my program at college which I have found to be of little or no value. I only wish that my capacity and that of the curriculum had permitted more."

A state engineer in North Carolina makes a plea for some of the humanities and general subjects in an engineer's education and lays stress upon the fundamentals in education as follows:

"Particularly it seems that a broad training is of more value than a specialized training. In my daily contacts with other engineers, I am continually surprised at the lack that some of them have of the understanding of basic engineering principles."

By way of contrast, it should be pointed out that professional courses in law and medicine are based upon pre-professional courses of three or four years' duration, making the entire length of the course from seven to eight years, whereas the pre-engineering and professional engineering program is, by tradition, limited almost wholly to a total of four years.

The already full content of the undergraduate course and preference for graduate work is recognized by an alumnus, who writes:

"My preference is to retain the four years' course as that is probably best for the majority of students. It should give a broad general training in civil engineering without majoring in any particular branch. This would insure a good foundation on which to build after graduation. For those who have the time, money, and aptitude for graduate study, there should be courses available for them after graduation."

Not long ago, in his syndicated column, Dr. Glenn Frank, President of the University of Wisconsin, quoted a British scientist as follows: "It is futile to expect a university to furnish its students with all of the technical knowledge they will need in the execution of their professional duties as they go from school to work. Even such professional schools as journalism, business and engineering, make a grave mistake when they spend too much time on these purely technical aspects of these professions." Something of the same idea was expressed in a letter from a graduate who is connected with a state department of public works. He writes as follows:

"It has always been my idea that an engineering training should devote itself largely to theory, especially in connection with design, and I have found that the men who come to me with a thorough grounding in mechanics and with a good working knowledge of mathematics up through calculus are able to do any of the work required in our department. The specialized training in design, such as structural or hydraulic, may be useful in giving them a slight understanding of how to apply the theoretical knowledge they have acquired, but in itself such training seems to be of little benefit. The detail work in any office follows definite lines which have been adopted to fit the peculiar problems encountered and the general type of design which they have used in college is seldom applicable."

Another state official points out the two general groups into which engineering graduates may be classified, as follows:

"From my own personal experience, civil engineering in public service is really divided into two parts. In one group are the engineers who become the executives, or leaders, so to speak. These men in addition to all the civil engineering subjects, should also have, perhaps, additional courses in taxation, general law, finance, economics, and public speaking. In addition, and above all, they must be practical in order to fit in with the general public in the ways of doing things. I know of nothing that will lower the opinion of an engineer more quickly in the eyes of the public than to spend the public funds on some impracticable or theoretical project."

"The other group referred to above, are the men who do the fact finding, research work, designing, detailing, computing and so on. This group obviously, is necessary and important, but is not generally in contact with the public. This group would probably not gain materially by taking extra courses enumerated for Group I."

and in conclusion, he makes this observation:

"In addition to the above, graduates should not seek public service thinking of an easy life but should have a strong personality, leadership, and enthusiasm to ward off political influences that so often creep in on capable and efficient public employees."

The importance of courses in English and training in public speaking were emphasized several times. This expression from the district engineer of a federal department is typical:

"The four year course is very crowded and I do not see the opportunity for making a very material change. I do feel very strongly that a greater emphasis on English, directed toward the preparation of clear, convincing and readable reports and training in oral expression, would be very desir-

able. To this I would add, if possible, some courses in business administration."

Another, a state official, adds:

"The weak point, as I see it, common to most engineering graduates, is their lack of ability to use the English language either in letters or in public speaking. Any engineer who gets into public service is apt to be placed in a position where it is necessary for him to be able to express himself concisely and intelligently on subjects connected with his work, without immediate preparation. I find that many of the men with whom I have contact are unable to get on their feet and talk. It would seem to me that a course of study in which the students would be required to discuss topics more or less extemporaneously would be of great value to them if they should ever enter public service."

and a similar view is taken by a county superintendent, as follows:

"A person engaged in public service sometimes is confronted with the necessity of speaking in public. This is very difficult for some people, if not almost impossible. I mean, of course, it is impossible for them to be good speakers. Doubtless, a course in public speaking would be necessary, not to develop orators, but to improve the speaking ability, so far as possible."

I think it is generally recognized that the already crowded program of study in the four-year course in civil engineering makes it practically impossible to introduce additional courses of study. Also, if emphasis is to be retained upon fundamental subjects, very little can be done in the way of substitution in the courses. It would therefore seem that the graduate school is the proper place for specialization in the field of public service.

One of our graduates who is a city engineer in Ohio writes:

"I do not think there is anything covered in the course as we had it which could very well be omitted, for a man preparing for public service in engineering work as a municipal engineer or department head necessarily has to cover a very wide field of operations. My suggestion would be that the course should be extended for another year or two and additional courses added."

And the importance of reading and self study is emphasized as follows:

"It is necessary for a municipal engineer to keep his education up to date with modern methods and procedures by constant study and reading as long as he is engaged in this work. Of course, this is probably just as true in any other engineering line but has been very strikingly noticeable to me in the pursuit of municipal work."

Another city engineer draws a distinction between the qualifications of engineers for technical and administrative positions, as follows:

"If I were setting up a program of study for civil engineering students who expect to have a career in public service, I do not think I would change the curriculum particularly except to emphasize a course of study that would prepare the student to administer and manage public works projects.

"I believe most of the civil engineering graduates are capable of designing, inspecting, and supervising construction of public works projects, but they are not prepared by training to manage a department of public works."

It is my belief that certain engineering students but not all who seek careers in public service would profit by graduate studies and there would be some advantage if these could be taken after a few years of practical experience. Advanced study would seem to be most essential for those who aspire to administrative positions, and the courses for this group would be for the most part subjects that come under the classification of economics or political science. Specifically, the subjects would have to do with personnel, law, labor, accounting, planning, utilities, health, police, statistics, welfare, etc.

Training for public service will, however, fall short of its best attainment if it is left to the schools and to the accidental selection of this field by the students themselves. Rather, it seems to me, training for public service should be a joint responsibility of the universities and public works societies such as are represented here today, and also the civil service commissions.

At the outset, students in freshman orientation courses could be made acquainted with this field. Student chapters of the American Society of Civil Engineers and other student branch societies also afford an opportunity to bring the field of public service to the attention of students.

Certainly, some established cooperative arrangement should be worked out so that the selection of public service as a career is not limited to mere chance. These contacts, of course, should apply not only to civil engineering but to all professional engineering groups. Students in college should not only be made acquainted with the field of public service but to those who show interest and have intellectual ability, good personalities and qualifications, practical experience should be made possible by assured summer employment or by part time employment during the school year.

Some way should also be provided without undue financial sacrifice for those now employed to return to the universities for further training, if they so desire and if their superiors feel the study is warranted. Those now in responsible charge of departments of public service could without doubt select candidates from their organizations who would profit by this training.

For many years the most progressive industries of the country have kept in systematic contact with the colleges for the purpose of recruiting the most promising young people to their organizations. Should there not be the same definite and organized program for recruiting for the public service? In this connection, it should be mentioned that this is the policy of the Tennessee Valley Authority and this public agency is, as far as I know, the only one that has a systematic and definite procedure of recruiting which is similar to that of the industries.

And, finally, those who aim at administrative positions in public service will find in the West Point Military Academy manual on *Official Courtesy and Customs of the Service*, some excellent suggestions concerning discipline, official courtesy, professional and social customs that should be a part of the training for those who are to be the officers in civil life.

DISCUSSION

MR. W. E. ROSENGARTEN (Ardmore, Pa.): It may be of interest to Dean Mitchell that the University of Pennsylvania some years ago made a study of those who have been out for some years, requesting from them comments on the courses being given at the time. Like the answers that he received,

many of the engineers felt that courses in public speaking and psychology would be of considerable assistance to city engineers in later life.

MR. A. E. ROCHÉ (Troy, N. Y.): Mr. Chairman and Gentlemen: I am as interested in the paper presented by Dean Mitchell of Syracuse as anybody could possibly be. I am interested because I occupied a position of public trust for a number of years, and it was my business to attempt to convince the public authorities that a Department of Public Works should be presided over by men of the engineering profession. There was one thing that I seemed to find essential for the proper conduct of a Department of Public Works which I did not get in the training I secured from my polytechnic institute and it pertained exclusively to accounting. I found that most of the engineers and many of the public works officials were deficient in their ability to tell a true cost of public works as it pertained to maintenance and general up-keep. Out of that observation there came into these societies a committee known as the Cost Accountant and Record Maintaining Group. This society established in the course of two or three years a group of men whose business it was specifically to go into a municipality and ascertain the true cost of the performance of work with which we are most intimately identified. I refer to street cleaning and garbage and ash collections. I don't know of any type of municipal work that comes into more intimate contact with the public than maintaining the cleanliness and health of the city.

So, I believe that the Dean's paper should embrace in some manner an item pertaining to cost accounting so that the Department of Public Works may be able to present to the city and to the citizens information as to the cost of performing these classes of work. The reports that were given the other night concerning the formation of manuals on these two subjects—street cleaning and garbage and refuse collection—are in the course of preparation with a definite viewpoint. That viewpoint is such that these manuals when completed may be utilized in the universities and in the technical schools in the training of men who are to enter the public service so that they may have some definite facts as to what is transpiring in those classes of public works. As a member of that Committee I find myself wholly in sympathy with the Chairman who reported here the other night that many of the municipalities failed to respond to the questionnaire he had sent out, and I plead with each of you to respond more readily so that the men preparing the manuals can put all of that information into a shape that can be used in universities and technical schools as an initial course in the subject of cleaning and sanitation.

I observed in a question asked by the Commissioner of Works of Toronto on the paper pertaining to Ann Arbor's low cost paving work that he was a bit surprised at the low rental cost charged by the City of Ann Arbor in the rental of equipment. Troy, N. Y., was one of the cities in which the cost accounting and record system initiated by this society had been installed. The accountants from the International Association of Public Works Officials installed at Troy an elaborate system, and I am not at all amazed at the answer that was given to the Commissioner when he inquired as to the cost. And unless any of the other men in the room be equally amazed at the cost of the rentals, let me remark to you here what we found to be the cost of the rental of various pieces of municipal equipment over a period of five years at Troy. For instance, our hourly rental cost on street flushers of 1500 gal. capacity was 72 cents an hour. Now, let me qualify that to this extent: that is, exclusive of the

wages of the operator, but it is inclusive of every other conceivable operation, every other conceivable degree of work performed on that flusher including its daily maintenance, equipment, insurance, overhead, tires, gas, oil, grease, repairs, and labor essential to make those repairs.

The cost of operating motor pick-up brooms, for instance, is 52 cents an hour, exclusive, of course, of the operator's wages. The cost of street cleaning with those rotary brooms is at the rate of 49 cents per mile.

I am giving you that information for this reason: the engineer who is going to enter the public service must have some definite training in accounting as well as in technical subjects which enter into his profession, and he should have that when he is in school. Thank you.

BUSINESS PROCEEDINGS

MEETING OF JOINT ADMINISTRATIVE BOARD DETROIT, MICHIGAN

April 4, 1936

THE Joint Administrative Board of the American Society of Municipal Engineers and the International Association of Public Works Officials met at 10:00 A.M. on April 4, 1936, at the Statler Hotel in Detroit, Mich. William J. Galligan, Chairman of the Board, presided. Thomas Buckley, George B. Gascoigne, Mark B. Owen, J. E. Root, Guy Brown, Alfred E. Roche, Harrison P. Eddy, Jr., Harold Bradley, Frank W. Herring, and Norman Hebden were present.

The financial statement showing receipts and disbursements of the Joint Secretariat for the first quarter of 1936 was presented and it was noted that expenditures were running well within the budget figures. The audit report of Haskins and Sells, certified public accountants of Chicago, was presented and approved.

The executive director announced that delivery of the 1936 Public Works Engineers' Yearbook would be delayed about two weeks because of the necessity for rebinding. It was decided to distribute old "Proceedings" to public officials who would request them for membership promotion or other purposes. A motion was carried to send copies of the 1936 Yearbook to a number of foreign public works officials as requested by Robert Brooks.

Considerable discussion was given to membership extension, particularly in regard to state sections. The executive director reported the results of his trip to Ann Arbor, Mich., where he met the Executive Board of the City Engineers' section of the Michigan Municipal League. He suggested his making a trip through Michigan to meet the various members of that group. It was suggested that a dinner meeting be held at the conclusion of the Michigan trip at which a Michigan section would be formed.

It was also reported that this work in connection with the Missouri League was progressing. Walter Heimbuecher of University City, Mo., is pushing the work in that state and has asked the executive director to assist in organizing a city engineers' section of the league. Contact with the California League of Municipalities has been made through H. W. Hincks, city engineer of Pasadena. The response was sympathetic but no further action has taken place.

The board was in accord with this membership extension work and approved carrying it further.

The outlines of the manuals on street cleaning practice and refuse collection and disposal methods were read and given consideration. The Board expressed its pleasure at the scope of the work outlined.

The cooperation of the Joint Secretariat with Professor Saville of New York University in arranging a program for a three-day school covering public works was described. The school is to be held at New York University on May 6, 7, and 8. The short course was organized and its administration is solely the responsibility of the University. However, the executive director has assisted

materially in the organization and in arranging the program. The subjects to be treated are not "primer" subjects but deal with the broad administrative problems of the public works field.

It was reported that Armour Institute, of Chicago, is now engaged in setting up a research station for the purpose of conducting studies in the field of refuse collection. The studies now outlined are designed to make possible evaluation of service rendered, methods employed, and similar subjects. The executive director has been cooperating in these arrangements.

In the opinion of the Board it was desirable to continue and further such contacts and cooperative efforts.

Consideration was given to the index of the past Proceedings of the AME and the IAPWO which has been compiled by the staff of the Joint Secretariat. It was decided to publish the index at an expenditure not to exceed \$250.

The question of reprinting recent specifications, such as the one on Cold Laid Asphalt, for free distribution to members was taken up. The consensus was that the expense of reprinting such specifications separately was not warranted.

The question of whether or not the assembled specifications should be reprinted annually was briefly discussed but the Board voted to table the discussion until the June meeting.

Approval was given to the arrangements which have been made for exhibit space at the 1936 Public Works Congress. The Royal York Hotel in Toronto will be the headquarters. The plan to sell exhibit space in conjunction with advertising in the 1937 Yearbook was approved. It was decided to give preference in the choice of exhibit booths to those companies which have exhibited at past congresses or advertised in past Proceedings.

The report of the committee charged with the responsibility of formulating the program for the 1936 conference was presented by the executive director and approved.

A motion was passed appointing a committee of three to study, discuss, and set up the facts relative to the advantages and disadvantages of a possible merger of the American Society of Municipal Engineers and the International Association of Public Works Officials. The members of this committee are W. J. Galligan, W. W. DeBerard, and Mark B. Owen. The executive director is to study the respective constitutions of the two organizations and is to assist in the preparation of the report of this committee.

After agreeing that the Board's next meeting should be held in Toronto in June 1936, the meeting adjourned at 10:30 P.M., April 4.

MEETING OF JOINT ADMINISTRATIVE BOARD TORONTO, ONTARIO

June 26-27, 1936

THE Joint Administrative Board met at the Royal York Hotel in Toronto, Ontario, June 26 and 27, 1936. William J. Galligan, Chairman of the Board, called the meeting to order at 10:30 A.M. Those present were George B. Gascoigne, J. E. Root, Guy Brown, Alfred E. Roche, Harrison P. Eddy, Jr., Harold D. Bradley, Frank W. Herring, and Norman Hebden.

A resolution authorizing the assistant director, Norman Hebden, to approve

statements and sign checks in the name of the Joint Administrative Board in the conduct of the Joint Secretariat's business, was presented and unanimously approved.

The executive director reported the progress made relative to the establishment of local or state chapters. A dinner meeting was held on May 26 at Lansing, Michigan, attended by city engineers and directors of public works from a number of Michigan municipalities. Those present favored the establishment of a state chapter of the AME and IAPWO and so voted. A local chapter was organized in Rochester on June 2 and the executive director expressed pleasure in the vitality displayed by the group. He reported that preliminary negotiations have been taken up with the Minnesota Municipal League concerning the organization of a chapter of AME and IAPWO made up of the engineers and public works officials who are members of the League. He also reported that similar negotiations with the Missouri Municipal League have been dropped.

The Joint Administrative Board recommended that the establishment of the Michigan and Rochester Chapters be approved and a motion was passed to this effect.

Some discussion ensued as to the document establishing the chapter and the proper body to approve it, including the by-laws. The opinion of the Board was that the executive director should draft a letter of application, addressed to the Board of Directors and the Board of Governors, which would be signed by the petitioning chapter's officers. This letter should state that the Joint Administrative Board recommends the establishment of the chapter. The Boards should then vote on the question, notifying the executive director who in turn notifies the chapter of the decision.

It was decided to print the index to the Proceedings and bind in cloth at whatever cost was necessary. Discussion was also given to reprinting the specifications of the AME which are now out of print. The Board instructed the executive director to get in touch with the chairmen of the specification committees to determine which specifications can and should be reprinted as they now stand, and those which must be revised. The actual printing or reprinting is to be deferred until the matter is taken up at the next Board meeting at the time of the convention.

Attention was given the selection of the technical papers to be presented at the annual meeting and considerable discussion ensued. A program was agreed upon.

Plans for the unification of the AME and IAPWO were the subject of lengthy discussion. The executive director read a proposed constitution of a unified organization in compliance with the request of the committee appointed at the last Board meeting to study the question. A number of suggestions were made and it was moved to have the revised document reviewed by counsel, for the executive director to send the revised copy to each Joint Board member for his further suggestions, for the executive director to correlate their suggestions and forward copies of the final revised draft to the Board of Directors and the Board of Governors of the respective organizations prior to the annual meeting.

The meeting adjourned at 5:00 P.M., June 27, 1936.

MEETING OF JOINT ADMINISTRATIVE BOARD
TORONTO, ONTARIO*September 27, 1936*

THE Joint Administrative Board met on September 27 at Toronto, Ontario, with W. J. Galligan, Chairman of the Board, presiding. The meeting was called to order at 10:30 A.M., with the following members present: W. J. Galligan, Guy Brown, Harrison P. Eddy, Jr., Mark B. Owen, George B. Gascoigne, J. E. Root, Frank W. Herring, and Norman Hebden.

The executive director presented his annual report in which both the membership and financial status of the organizations are analyzed. (The text of this report is included in the report of the meeting of the Board of Directors and the Board of Governors, page 198.)

The Board gave considerable thought and discussion to the proposed constitution of the American Public Works Association. Each section of this proposed document was examined minutely and revisions were made. After complete discussion, a motion was made that the proposed constitution, as revised, be approved. The motion was carried.

The Chairman of the Joint Administrative Board, W. J. Galligan, next presented his report summarizing the activities carried on during the year. (The text of this report is included in the report of the meeting of the Board of Directors and the Board of Governors, page 197.)

Publication of the index to the Proceedings and the specifications was discussed and a motion was made and carried that the specifications be reprinted; that the sum of \$1000 be transferred for the purpose of reprinting the specifications and \$200 additional be transferred for the binding of the index.

In view of the fact that Mr. Moffett was unable to attend the Congress, it was moved and carried that the executive director should advise him as to what took place.

The meeting adjourned at 1:00 P.M.

MEETING OF BOARD OF DIRECTORS OF
AME AND BOARD OF GOVERNORS OF IAPWO
TORONTO, ONTARIO*September 27, 1936*

THE Board of Directors of the AME and the Board of Governors of IAPWO convened at the Royal York Hotel, Toronto, Canada, at 3:00 P.M. Sunday, September 27, 1936. Chairman Galligan called the meeting to order. Those present were, besides the Chairman, Guy Brown, Harrison P. Eddy, Jr., George B. Gascoigne, Mark B. Owen, J. Eugene Root, Henry L. Howe, Roy L. Phillips, P. O. Brockway, W. W. DeBerard, C. Arthur Poole, E. S. Rankin, W. E. Rosengarten, John S. Flockhart, Frederick T. Paul, A. M. Anderson, Edwin A. Miller, Harold D. Bradley, W. G. Conrath, Lester W. Herzog, William B. Shafer, Executive Director Herring, and his assistant Norman Hebden.

Chairman Galligan presented his report as Chairman of the Joint Administrative Board, as follows:

REPORT OF THE CHAIRMAN OF THE JOINT ADMINISTRATIVE BOARD

Five meetings of the Joint Administrative Board have been held since the Cincinnati meeting of the Board of Directors of the AME and the Board of Governors of the IAPWO.

The first meeting was held on October 16, 1935, at Cincinnati, directly following the close of the 1935 Public Works Congress. At that meeting, William J. Galligan was reelected chairman and Thomas Buckley vice-chairman. The recommendation of the Development Committee regarding the selection of an executive director was adopted by the Board, and Frank W. Herring was appointed executive director and secretary-treasurer of the Joint Administrative Board.

The second meeting was held in Cleveland, Ohio, on December 13 and 14, 1935. After canvassing invitations from Detroit, New Orleans, Philadelphia, Washington, St. Louis, Toronto, Atlantic City, and Chicago, the Board decided to hold the 1936 Public Works Congress in Toronto. A Program Committee consisting of George B. Gascoigne, A. M. Anderson, Mark B. Owen, C. W. S. Sammelman, and Frank W. Herring was appointed.

In deciding upon a program of activities for 1936, it was agreed that two manuals of practice in the public works field should be prepared—one on street cleaning practice and one on refuse collection and disposal practice. The preparation of these manuals was made the responsibility of the committees on those two subjects respectively. The Joint Board has given considerable attention to the work of these committees and it is pleased to report that substantial progress has been made. The chairmen of these two committees will report to the convention on Monday night.

The budget for 1936, in the form it appears in the report of the executive director, was adopted. That budget has now been in operation for eight months and an estimate of receipts and expenditures for the remainder of the calendar year shows that the expenditures of our organizations will be within our revenues.

The third meeting of the Board was held in Detroit, Michigan, on April 4 and 5, 1936. Most of the discussion at this meeting was given to the adoption of a program for the 1936 Public Works Congress. A four-day program was approved. It was also decided that committee reports to be presented at the conference should be given in abstract only.

To comply with instructions given by the Board of Directors of the AME and the Board of Governors of the IAPWO at the time of the Cincinnati meeting regarding plans for further unification of the activities of the two organizations, a committee of three was appointed to study the facts relative to a merger of the AME and IAPWO. This committee consisted of W. J. Galligan, W. W. DeBerard, and Mark B. Owen.

At the fourth meeting of the Board in Toronto, Ontario, on June 26 and 27, 1936, exhaustive discussion was given to this subject of unification. Substantial agreement was reached upon a proposed draft of a constitution to serve both organizations, and differences of opinion on the details of the document subsequently have largely been ironed out by correspondence with the members of the Board.

At the last meeting of the Board held this morning, the Board decided to recommend that this document be submitted for the approval of the Board of Directors of the AME and the Board of Governors of the IAPWO, and that, subject to their approval, the executive director be instructed to canvass the membership of both organizations by letter ballot for its approval.

Chairman Galligan's report was accepted. The executive director then presented his report, as follows:

ANNUAL REPORT OF THE EXECUTIVE DIRECTOR

This report is to be considered as of September 1, 1936, and with the exception of the financial statement in a later paragraph the statistical data reported are for the twelve months ending on that date. Inasmuch as the supplementary financing we are receiving from the Spelman Fund must be accounted for at the end of each calendar year, it has proved highly desirable to keep the financial books of the Joint Secretariat on a calendar year basis. Accordingly, the statements of receipts and disbursements will be reported for the eight months ending September 1, 1936.

Current Membership Status: On September 1, 1935, there were 885 members enrolled in the American Society of Municipal Engineers and the International Association of Public Works Officials. There were unfortunately, however, a large number of these who were far in arrears in dues, and after extending to this group an offer of reinstatement in good standing provided they paid dues for the year then current, a total of 153 were dropped from the rolls in November. The two organizations suffered further loss in membership through 43 resignations and 9 deaths. During the year, however, 98 new members were elected and 6 former members were reinstated. The total membership on September 1, 1936, therefore, was 784. In addition, on that date there were 23 applications pending, not yet acted upon by the membership committees.

Considering only those not in arrears in dues, there were 628 members paid up to date at the end of the year, contrasted with 609 on September 1, 1935. These statistics are presented in detail at the end of this report.

Membership Promotion Activities: Throughout the year a vigorous campaign of membership extension has been carried on by the headquarters staff. The method employed has been an intensive but systematic cultivation of a carefully selected group of individuals considered to be likely prospects. In many instances the names of these individuals have been made available through the cooperation of our members. Wherever it has been possible to do so, the aid of the membership has been solicited by the staff in getting a prospect to sign an application form. This cooperation has been promptly given in many instances and has proved highly effective. The 98 new members elected, plus the 6 former members reinstated, can be compared with the 58 new members elected during the preceding year.

At the end of this report is an analysis of the new members according to field of activity and according to geographical distribution.

Financial Status: There is included in this report a statement of the receipts and disbursements of the Joint Secretariat for the eight months ending

August 31. This statement includes the budget figures established by the Joint Administrative Board at its meeting in December, 1935.

Careful study of this statement indicates that the expenditures for the remaining months of the calendar year will be within the estimated revenues.

Chapter Organization Activities: Activities designed to further the establishment of additional chapters have been undertaken during the year.

In cooperation with Henry Howe, Edwin A. Miller, and four other members of our organizations in the city of Rochester, a dinner meeting was held in that city on June 2, 1936, with about 50 public works engineers of the region in attendance. The group decided to petition the Board of Directors of the AME and the Board of Governors of the IAPWO for the establishment of a Rochester Chapter and elected the following officers:

Thomas J. Morrison, *President*; Morgan D. Hayes, *First Vice-President*; John V. Lewis, *Second Vice-President*; and Henry L. Howe, *Secretary-Treasurer*.

This petition was formally submitted to the Board of Directors and the Board of Governors as of September 1. The 38 applications for membership accompanying the petition are in addition to the pending applications reported in an earlier paragraph. (Since the report was written, the ballot from the Board of Directors and Board of Governors has been received and the Rochester Chapter has been formally established.)

Similar efforts have been made toward the establishment of a Michigan State Chapter. On May 26, 1936, a meeting of the members of both organizations living in Michigan was held in Lansing, and drew the attendance of 20 representatives of the public works field in that state. In this instance it has been proposed that the state chapter operate in close cooperation with the Michigan Municipal League. The meeting decided unanimously to petition for the establishment of the chapter and arranged for the preparation of by-laws and the election of officers. The petition will be presented for your consideration following the reading of this report.

A formal proposal has been extended to the Newark Municipal Engineers' Club to affiliate with our organizations as a local chapter, but there has been no response to this proposal.

Negotiations have also been opened with the City and County Engineers' Association of Los Angeles, California, looking toward their affiliation with our organizations as a local section.

State Meetings: The executive director has in three instances participated in state meetings of public works officials. It is hoped that this participation has laid the ground work for the establishment of future sections of the AME and IAPWO. These meetings were held in New York under the auspices of the New York State Association of City and Village Engineers, in Missouri under the auspices of the Missouri Municipal Association, and in Minnesota under the auspices of the League of Minnesota Municipalities. Harry Eustance of Ithaca, New York, Walter Heimbuecher of University City, Missouri, and Fred T. Paul of Minneapolis, Minnesota, were the prime movers in these state meetings.

Yearbook: The 1936 edition of the Public Works Engineers' Yearbook, containing the proceedings of the 1935 Public Works Congress, was given publica-

tion in March. The total distribution to date has been 816. In addition to distribution to members and to an exchange list, 105 copies were sold. The revenue from advertising received as of September 1 was \$777. This is to be compared with \$520 during the preceding year.

News Letter: With the approval of the Joint Administrative Board, the first page of the News Letter was given over to an editorial statement signed by the executive director starting with the January 1936 issue. These statements have received considerable attention in the public press and have been means of gaining publicity for our organization, although in all instances the executive director has been held solely accountable for the statements made.

The circulation of the News Letter has been in the neighborhood of 1500. This figure includes about 700 prospective members. In fact, the News Letter has proved a valuable instrument in our membership extension activities. During the past two months the circulation has been increased to about 4000 in order to publicize more widely the Toronto meeting.

Index to Proceedings: An index to the published proceedings of the American Society of Municipal Engineers and the International Association of Public Works Officials from 1918 and 1926 to date respectively has been prepared. Provision has been made in the budget for its publication, and the copy will be sent to the printer in a few weeks. It is believed that this index will greatly facilitate the use of the valuable information contained in the back volumes of these proceedings.

Manuals of Public Works Practice: Two manuals of practice, one in the field of refuse collection and disposal and one in the field of street cleaning, are in process of preparation by the committees responsible for developments in those two phases of the public works field.

When these manuals are completed, it is intended to give them publication and to distribute them among the members.

Standard Specifications: The Standard Specifications of the American Society of Municipal Engineers are now out of print. Requests are still being received for them, however, and it is thought desirable that they be reprinted. Chairmen of the various committees have been queried regarding the condition of the specifications in their charge. The specifications on sewers and street railway tract construction, and the standard municipal contract form have been judged obsolete and should not be reprinted. The committee on subgrades and foundations is to have a meeting tomorrow afternoon to consider the need for revision of the specifications in its charge. All other specifications are considered proper for reprinting, subject to some minor editing.

Miscellaneous Headquarters Activity: A three day seminar in public works administration sponsored jointly by our organizations and New York University was held in New York City in May. The Secretariat staff assisted in the preparation of the curriculum and in arranging for the participation of special lecturers. The subjects covered included public works finance, public works purchasing, planning, personnel problems, and intercommunity problems. Those who attended were drawn from the public works service in the New York region.

The staff also cooperated with the New York State Conference of Mayors in

the biennial school for public works officials held later in the same month. The executive director was one of the lecturers at this school.

Staff Changes: Waldo Wegner, the apprentice attached to headquarters staff, completed his apprenticeship on July 1, and has returned to the WPA in Washington.

On February 1, Mr. Norman Hebden joined the staff as assistant director.

New Building: Funds have been made available by the Spelman Fund for the construction of a new building on the campus of the University of Chicago to house the groups of organizations now at 850 East 58th Street. Architectural plans for this building are now virtually complete, and it is expected that the contract for its construction will be let very shortly. The building is scheduled to be ready for occupancy in the fall of 1937.

Plans for Unification: Under the close direction of the Joint Administrative Board, the headquarters staff has devoted a considerable amount of time to the work involved in developing plans for further unification of our two organizations. This subject will be reported on by the chairman of the Joint Administrative Board.

I have a petition here to establish a Chapter in Michigan, which I am turning over to Mr. Galligan.

STATEMENT OF CASH RECEIPTS, DISBURSEMENTS, AND BALANCE
FOR THE EIGHT MONTHS ENDED AUGUST 31, 1936

		Income	
		Estimated for the Year 1936	Actual for the Year to Date
CASH RECEIPTS			
Balance, January 1, 1936	\$ 800.00	\$ 1,451.62
Spelman Fund of New York			
Appropriation No. 193		20,000.00	15,000.00
Membership Dues			
American Society Municipal Engrs.			665.50
Internat'l Ass'n Pub. Wks. Offs. ...			117.10
Joint Memberships			615.00
Total Membership Dues		\$ 5,800.00	\$ 1,397.60
Sale of Yearbooks			233.75
Sale of Advertising in Yearbook			768.10
Sale of Other Publications			32.25
Total Sales of Publications and			
Advertising		\$ 1,000.00	\$ 1,034.10
Sale of Convention Space		1,400.00	
Miscellaneous Income			34.00
Total Cash Receipts		<u>\$29,000.00</u>	<u>\$18,917.32</u>

	Expense	Expended for the Year to Date
EXPENSE DISBURSEMENTS	Appropriations for Year 1936	
General Administration	\$11,135.00	\$ 6,327.15
General Operating Expense	7,500.00	4,883.67
Membership Administration	1,100.00	537.13
Membership Extension	2,110.00	1,022.14
News Letter	1,185.00	681.64
Yearbook	2,100.00	1,975.33
Miscellaneous Publications	350.00	75.19
Conferences	1,830.00	375.07
Research and Advancement of Practice	1,015.00	717.70
Chapter Aid	675.00	160.64
Total Expense Disbursements	<u>\$29,000.00</u>	<u>\$16,755.66</u>
BALANCE (Excess of Receipts over Disbursements)		<u>\$ 2,161.66</u>
BALANCE represented by		
Cash on Deposit		\$ 2,134.26
Petty Cash Fund		25.00
City Warrants Owned		2.40
		<u>\$ 2,161.66</u>

REPORT OF CHANGES IN MEMBERSHIP OF THE AME AND IAPWO,
DURING THE YEAR ENDING SEPTEMBER 1, 1936

	AME	IAPWO	JOINT	TOTAL
Total Membership Sept. 1, 1935	574	149	162	885
Resignations	-29	-10	-4	-43
Deaths	-6		-3	-9
Dropped for non-payment of dues	-118	-35		-153
New Members elected (in- cluding Honorary)	+6		+92	+98
Transferred to joint listing	-25	-11	+36	
Reinstatement of former members	+3	+2	+1	+6
Net gain or loss	-169	-54	+122	-101
Total Membership Sept. 1, 1936	405	95	284	784
Applications pending	5		18	23
Total	410	95	302	807

ANALYSIS OF PAID-UP MEMBERSHIP

Paid to:	AME	IAPWO	JOINT	TOTAL
Sept. 1, 1937	48	4	34	86
Mar. 1, 1937	6	3	36	45
Sept. 1, 1936	260	53	184	497
Pending Applications	5		18	23
TOTAL Sept. 1, 1936	319	60	272	651

ANALYSIS OF NEW MEMBERS OF AME AND IAPWO
BY TYPE OF AGENCY REPRESENTED

Municipal Officers	55
County	5
State	5
Federal	15
Consulting Engineers	4
Professors (Engineering schools)	2
Others	<u>12</u>
	98

GEOGRAPHICAL DISTRIBUTION OF NEW MEMBERS

Alabama	2	Minnesota	1
Arkansas	1	Nebraska	2
California	1	New Jersey	4
Dist. Columbia	11	New York	7
Florida	2	North Carolina	1
Georgia	1	Ohio	17
Illinois	10	Pennsylvania	8
Indiana	3	Texas	1
Kentucky	5	West Virginia	2
Louisiana	1	Wisconsin	2
Maryland	1	Foreign	<u>3</u>
Michigan	12	Total	98

The report of the executive director was accepted.

The petition to establish a chapter in Michigan was referred to a committee composed of Mr. Root, Mr. Rankin, and Mr. Brown, for a report to a later meeting of the Board.

The proposed new constitution of the unified American Public Works Association was then read and discussed, section by section. As approval of the constitution was reserved for action by the individual organizations, the meeting adjourned at 5:30 P.M. to give the individual Boards an opportunity to meet.

MEETING OF BOARD OF GOVERNORS OF IAPWO

September 27, 1936

THE annual meeting of the Board of Governors of the IAPWO convened at 5:30 P.M. September 27, with President Mark B. Owen presiding.

President Owen called upon E. A. Miller, Treasurer, for his annual report. Mr. Miller stated that he wanted to delay submitting his report in order to check some variances with the records of the Joint Secretariat. Permission was granted.

A nominating committee composed of D. F. O'Brien, W. B. Shafer, H. Bleek, H. J. Cates, and L. P. Booz was appointed to select the slate of new officers for the coming year.

The proposed constitution of the American Public Works Association was discussed at some length, and finally approved as slightly amended.

A committee consisting of W. J. Galligan and L. W. Herzog was appointed to act with a corresponding committee of the AME to select candidates for the officers of the united Association to serve from January 1, 1937 until the 1937 annual meeting.

The meeting adjourned at 6:15 P.M.

MEETING OF BOARD OF DIRECTORS OF AME

September 27, 1936

A MEETING of the Board of Directors of the AME convened at 5:40 P.M. September 27, 1936, with President George B. Gascoigne presiding. Roy L. Phillips, national treasurer, submitted his report, which was accepted. (For text of this report, see page 205.)

A committee consisting of Messrs. Eddy, DeBerard, Howe, and Herring (ex officio) was appointed to study the matter of the disposition of the funds remaining in the treasury in the event the unification of the two organizations was approved.

Upon a motion seconded and carried, the chairman appointed an auditing committee consisting of Messrs. Brockway, Rosengarten, and Poole.

It was moved and carried that the Board of Directors of the AME approve the plan for unification proposed by the Joint Administrative Board, and the constitution as presented, and instruct the executive director to canvass the membership by letter ballot, and that in event of an affirmative vote the constitution should become effective as of January 1, 1937.

A nominating committee was appointed consisting of Messrs. Eddy and Rankin. Mr. Eddy offered a suggested ballot from the floor, the names to be taken in the order given, subject to loss of any of them by nomination as officers of the society: George B. Gascoigne, Thomas Buckley, Guy Brown, Henry L. Howe, Roy L. Phillips, P. L. Brockway, W. W. DeBerard.

The meeting adjourned at 6:30 P.M.

MEETING OF BOARD OF GOVERNORS OF IAPWO AND BOARD OF DIRECTORS OF AME

September 27, 1936

AT 9:00 P.M. the same evening, the Board of Directors and the Board of Governors reconvened. Mark B. Owen reported for the Board of Governors of the IAPWO that that body had formally approved the proposed constitution, subject to certain amendments. George B. Gascoigne reported for the Board of Directors of the AME their approval of the constitution. The chairman then appointed Mr. Eddy and Mr. Brockway for the AME and Mr. Owen appointed Mr. Shafer and Mr. Herzog for the IAPWO as a joint committee to discuss the matter for a few minutes. This committee retired from the room.

The committee appointed to consider the petition for a Michigan chapter reported their recommendation to grant the petition and to adopt the by-laws submitted. The committee report was adopted.

The committee of four appointed to discuss the adoption of the constitution returned to the room and presented their unanimous report accepting the constitution with three slight alterations.

The report of the committee was unanimously accepted.

The meeting adjourned at 9:40 P.M.

BUSINESS MEETING OF THE AME

September 30, 1936

THE AME met in business session at 9:45 A.M. September 30, 1936. In the absence of the President and the First Vice-President, Mr. Guy Brown presided.

As the minutes of the meeting of the Board of Directors had not yet been written up, the executive director was called upon to give a resumé of the action taken at that meeting.

The national treasurer, Roy L. Phillips, presented his report, as follows:

REPORT OF NATIONAL TREASURER

Cash balance received by Roy L. Phillips as of September

25, 1935	\$4,139.54	
Dues received to August 31, 1936	2,091.34	
Dividends from Massachusetts Investors' Trust	<u>10.75</u>	\$6,241.63

Transfer of operating receipts to Joint Administrative Board
as per resolution of Board of Directors, October 13, 1936 561.50

Transfer of operating receipts to Joint Administrative
Board to August 31, 1936 1,590.45

Purchase 25 shares Massachusetts Investors' Trust 2,025.00

Purchase U. S. Government Bonds 2,151.95

Check to C. W. S. Sammelman—traveling expenses 54.74

Check to C. W. S. Sammelman—framing medals 1935 8.50

Check to St. Louis Button Co.—medals 1935 20.40

Check to St. Louis Button Co.—gavel 1935 14.30

Check to C. W. S. Sammelman—framing medals 1936 8.50

Check to St. Louis Button Co.—medals 1936 20.04

Bank Charges 7.39 5,009.82

Excess of cash receipts over cash disbursements \$1,231.81

Cash in Bank per bank statement, September 25, 1936. 2,041.30

Less checks outstanding 809.49

Cash balance per books \$1,231.81

AME Net Worth

Net Cash on Hand (per statement above) \$1,231.81

25 Shares Massachusetts Investors' Trust (Purchase
Price) 699.00

U. S. Government Bonds (\$2,700.00 at Maturity) at cost 2,025.00

Total Net Worth September 25, 1936 \$3,955.81

P. L. Brockway, reporting for the Finance Committee, stated that the committee had examined the treasurer's records, verified the bank statement, and found all records and accounts to be correct and in good order.

It was regularly moved and seconded that both the treasurer's report and the report of the Finance Committee be accepted. The motion was carried.

The Nominating Committee reported its nomination for the officers of the AME for the balance of the year 1936. They were: Thomas Buckley, *President*; Guy Brown, *First Vice-President*; Henry L. Howe, *Second Vice-President*; Frederick T. Paul, *Third Vice-President*; Roy Phillips, *Treasurer*. Mr. Rosengarten moved that the nominations be closed and that the secretary be instructed to cast a unanimous ballot for the officers nominated. The motion was unanimously carried.

In the absence of the newly elected President, Mr. Brown continued as chairman of the meeting.

The executive director read that portion of his report referring to the membership status of the association.

The reports of the Philadelphia Chapter, the Rochester Chapter, and the Chicago Chapter were read and greeted with applause.

The Committee on Specifications for Brick Pavements presented its report, which was read by Roy Phillips. (See page 74 for the text of this report.)

The executive director reported that the Veterans' Award Committee had made the following nominations for awards, all of which had been approved by letter ballot of the Board of Directors:

R. C. HARRIS, Toronto, Ont.

FRANK C. THOMAS, Philadelphia, Pa.

JOSEPH F. DELANEY, Philadelphia, Pa.

The Memorial Committee's report was read by the executive director as follows:

REPORT OF MEMORIAL COMMITTEE

News of deaths of eight members has come to the organizations since the last annual meeting. One of these was a past president of the IAPWO and another had been a member of the AME for 35 years. The deceased members are as follows: Thomas L. Costigan; George H. Hoskins; James Waite Howard; George C. D. Lenth; Robert Brooks Morse; Milton J. Ruark; H. L. Shaner; and Fred Wolffe.

GEORGE H. HOSKINS, member of the AME since 1933, died on March 13, 1935, at New Castle, Pa., after an illness of but three days. At the time of his death he was serving the city of New Castle as City Engineer.

He is survived by his wife and one son.

COL. JAMES WAITE HOWARD, senior member of the AME, aged 76 years, died on May 24, 1936 at the Homeopathic Hospital at East Orange, New Jersey, after a year of failing health. Colonel Howard was educated at Phillips Academy, Andover, Mass., and Rensselaer Polytechnic Institute, and also studied at Evreux, France; Geneva, Switzerland, and Goettingen, Germany. He traveled extensively studying public engineering works in Europe and the

United States, and engaged in gold mining in Oregon, lead mining in Missouri, and examined asphalt deposits in Cuba and Mexico.

He practiced as a consulting civil and mining engineer in Newark, New Jersey, up to the time of his death.

He was the author of numerous articles on street paving and was editor at one time of the Question Department of *Municipal Engineering* and engineering editor of the *Municipal Journal*. He served in both the Spanish American and the World War and was a member of the American Roadbuilders' Association and Rensselaer Society of Engineers. He joined the AME in 1901 and became a senior member in 1931.

He is survived by a daughter and two brothers.

GEORGE CASPAR DOERING LENTH died May 11, 1936, in Chicago at the age of 54. He received the degree of bachelor of science in Civil Engineering at Massachusetts Institute of Technology. In 1905, he was employed as an engineer by the Chicago Telephone Company; later he served the Cook County Clerk's office as engineer on special investigations. In 1905, he became engineer for bridge repairs for the city of Chicago; later he was transferred to the position of division engineer of sewers. From 1910 to 1921 he served as engineer for the Board of Local Improvements and Chief Engineer of Sewers for the city. In 1921, he became consulting engineer and Secretary of the Clay Products Association in Chicago, a position he held until the time of his death. He was also a member of the Advisory Subway Engineering Commission on Chicago Subways.

In 1918 he joined the AME and in 1935 the IAPWO. He served as member of the Committee on Sewer Specifications 1932-1936. He had been a member of the American Society of Civil Engineers since 1912.

He is survived by a widow and five children.

ROBERT BROOKS MORSE passed away January 31, 1936 in Washington, D. C., aged 55. He held degrees from Johns Hopkins and M.I.T. He was chief engineer of the Washington Suburban Sanitary Commission with headquarters at Hyattsville, Md., from 1918 until the time of his death, and had been identified with the city of Baltimore, 1905-1910, as draftsman and assistant engineer for the Sewerage Commission; with New York City as Sanitary Engineer for the Metropolitan Sewerage Commission, 1910-12; and the Maryland Department of Health, as Chief Engineer, 1912-22. He served on numerous planning commissions and was the author of various technical articles on water supply and sewerage.

He was a fellow of the American Public Health Association and joined the American Society of Civil Engineers in 1910. He was affiliated also with the American Water Works Association, the American Society for Testing Materials, the Maryland Water and Sewerage Association, the Maryland Association of Engineers, and the Baltimore Engineers' Club. He joined the AME in 1926.

He is survived by a widow and one daughter.

MILTON J. RUARK died August 1, 1936 at Sinai Hospital, Baltimore, Md.,

after a long illness. He was educated at Polytechnic Institute and Maryland Institute and entered the city service in 1902 with the Electrical Commission. In 1906 he was transferred to the Sewerage Commission under which he served first as assistant engineer, later as head of the Bureau of Drafting, then in 1918 as Division Engineer. From 1919-1931 he was head of the Sewer Division of the Highways Department. He then became Associate Engineer and Secretary to the Advisory Engineers on Water Supply for the city.

He was a member of the Maryland-Delaware Water and Sewerage Association and joined the AME in 1932.

He is survived by a widow and two sons, Milton H. and E. Gordon Ruark.

HARRY LINDEN SHANER died November 20, 1935 at his home at Winston-Salem, North Carolina, aged 56. He was a graduate of Virginia Military Institute. In 1899 he became Assistant City Engineer of Lynchburg, Va., and in 1904, City Engineer. At the time of his death he was Commissioner of Public Works of Winston-Salem.

He joined the AME in 1908 and had been a member of the American Society of Civil Engineers since 1904.

FRED WOLFFE died March 10, 1936 at St. Mary's Hospital, University City, Mo., aged 53. Death followed a month's illness. He had had charge of all Work Relief projects in St. Louis County under FERA and ERA for the past several years and at the time of his death was head of professional projects under WPA.

He joined the AME in 1931 and had served as president of the St. Louis chapter and was a member of its Executive Committee.

The meeting adjourned at 10:45 A.M.

BUSINESS MEETING OF THE IAPWO

September 30, 1936

THE business meeting of the IAPWO convened at 2:15 P.M. September 30, 1936, with President Mark B. Owen presiding.

E. A. Miller, national treasurer, presented his report as follows:

REPORT OF NATIONAL TREASURER

Cash balance on Sept. 1, 1935	\$662.75	
Dues received to August 31, 1936	<u>537.50</u>	\$1,200.25
Transfer of operating receipts to Joint Administrative Board as per resolution of Board of Governors, October 13, 1935	374.10	
Transfer of operation receipts to Joint Administrative Board to August 31, 1936	450.75	
Check to D. C. Stone for gavel	9.07	
Check to Rounds Freeman for engraving	16.00	
Bank Charges	1.65	
Returned Seattle warrant	<u>7.50</u>	859.07
		<u>\$ 341.18</u>
Cash in Bank per bank statement of September 25, 1936		<u>\$ 341.18</u>

Upon motion of Mr. Herzog, duly seconded, the report was accepted.

The executive director then gave a brief report of the activities of the Board of Governors. Mr. Herring also read the following memorial to the deceased member, Thomas Costigan:

THOMAS L. COSTIGAN, fourteenth president of the IAPWO, died April 23, 1936 in Washington, D. C., aged 63 years. From 1888 to 1906 he was a first-class pattern maker in the Naval Gun Factory, Washington Navy Yard. During the years 1892-1896 he attended Columbian University (now George Washington), majoring in chemistry, and took special courses in mathematics at the Linthicum Institute. In 1906 he became Assistant Engineer of Buildings and Bridges for the Missouri Pacific Railroad at St. Louis. He served as special representative for the Johns-Manville Company the following year, 1907-08.

In July, 1908, he returned to Washington and entered the District Government as an assistant foreman in the water department. In 1909, he became an engineer and computer in the Building Inspector's Office and served there until his transfer in 1918 to the City Refuse Division where he held the title of Superintendent of Street Cleaning. In 1934 he became Supervisor of City Refuse, a position he held at the time of his death.

He joined the Association in 1929 and became a member of the AME also in 1935.

Upon motion of W. J. Galligan it was voted to send a suitable resolution to the family of the deceased.

The Nominating Committee reported its nominations for the officers of the IAPWO for the balance of the year 1936. They were: J. Eugene Root, *President*; John S. Flockhart, *First Vice-President*; Frederick T. Paul, *Second Vice-President*; Henry L. Howe, *Third Vice-President*; Edwin A. Miller, *Treasurer*; A. M. Anderson, *Secretary*; and for the *Board of Governors*, Henry J. Cates, William G. Conrath, L. C. Dempsey, W. C. Dodd, William B. Shafer, Wilbur H. Winship, and Thomas Buckley. Mr. Gerlach moved that the nominations be closed and the secretary instructed to cast a ballot for the officers nominated. The motion was unanimously carried.

It was voted that the Association extend its thanks and appreciation to those members in charge of conducting the convention for the hospitality and reception received.

President-Elect Root assumed the chair, and after a few remarks expressing his hope for continued interest and enthusiasm for the new organization, the meeting adjourned at 2:40 P.M.

MEETING OF JOINT ADMINISTRATIVE BOARD
CHICAGO, ILLINOIS*November 21, 1936*

A MEETING of the Joint Administrative Board of the AME and IAPWO was held on Saturday, November 21, at the Congress Hotel in Chicago. Thomas Buckley, who presided, called the meeting to order at 10:45 A.M. Others present were Messrs. Galligan, Owen, Brown, Root, Roche, Herring, and Hebden.

The letter ballots returned by the membership on the question of the consolidation of the AME and the IAPWO, and the proposed constitution for the American Public Works Association, were counted and totalled. The final tally showed an overwhelming majority in favor of the amalgamation. The count was 278 to 11 for the AME, and 203 to 4 for the IAPWO.

After considerable discussion it was moved and carried unanimously to hold the 1937 Public Works Congress in Atlanta, Georgia; the preferred date to be between the fourth week in September and the second week in October.

Since the new constitution is to become effective on January 1, 1937, it was considered necessary for the new Board of Directors to meet early in the year. It was decided to hold the first meeting early in January, the ninth being the tentative date selected.

Considerable discussion was given to the selection of committees, and it was decided to postpone the actual selection until the new presidents had had time to study the membership roster.

It was moved that the executive director be instructed to send out for letter ballot the following nominations for officers of the American Public Works Association: Thomas Buckley, *President*; J. Eugene Root, *First Vice-President*; Guy Brown, *Second Vice-President*; John S. Flockhart, *Treasurer*.

The question of the disposition of the surplus funds held by the AME and the IAPWO was next discussed. A motion was passed to the effect that the Joint Administrative Board recommend that the funds of both societies be turned over to the Treasurer of the American Public Works Association on January 1, 1937, for such special use as may be determined by the special committees of the AME and IAPWO.

The executive director read the application for a new grant from the Spelman Fund for the years 1937 and 1938. He also read a review of the activities of the two societies for 1935 and 1936 which accompanies the application. The Board approved the application and report.

The meeting adjourned at 6:00 P.M.

REPORT OF THE PHILADELPHIA CHAPTER

THIS report brings to a close another year of activity of the Philadelphia Chapter of the American Society of Municipal Engineers. We would, therefore, look back for a few moments to see if we have in a measure accomplished or enjoyed those things for which we have banded together in this fellowship. We are organized to advance and disseminate theory and practice in municipal engineering and to develop the professional and social improvement of our members.

The principal activity of the chapter has been the nine monthly evening meetings. We have gathered at the Engineers Club of Philadelphia to discuss a variety of subjects dealing with our community and municipal development in general. These have included:

<i>Month</i>	<i>Subject</i>
1935: October	Report on the Cincinnati Convention of the National Society
November	Street Cleaning and Refuse Disposal
December	Christmas Party
1936: January	Annual Dinner with Medal and Prize Essay Awards
February	Aviation and the Philadelphia Airport
March	Parks and Playgrounds
April	Electrification of the Pennsylvania Railroad
May	Vehicular Tunnel under the Delaware River at Hog Island
June	Junior Engineers Night

These meetings have been most interesting and instructive, and have brought forth extensive and worth while discussions. They have attracted increasing numbers of members and guests. The attendance has been double that of last year, averaging 127 with a maximum of 162 at the May meeting and 200 members and guests at the January Banquet.

While the success of these meetings may be largely attributed to the excellent manner in which the carefully selected speakers presented their papers, and the response of the many who discussed the subjects, the real inspiration behind them was the entire Meetings Committee under the leadership of Frederick T. Thorpe, Jr., the committee chairman.

This year, as an innovation, three informal round table discussions were held on afternoons in the City Hall Annex, Philadelphia. Here were discussed the subjects of Storm Drainage Design, and Control of Real Estate Subdivisions. Although not attended by large numbers, the groups were intensely interested in the subjects and were unanimous in feeling that much had been learned through the exchange of ideas. It is believed that these discussions will be the beginning of many worth while gatherings.

The total membership of 100 places the Philadelphia Chapter still the leading Chapter in the national body. It is realized, however, that increasing activity in other sections will soon require the Philadelphia Chapter to forge ahead if it is to maintain its supremacy. The number of paid memberships has been somewhat disappointing in spite of the active work of the Membership Committee headed by Albert Moser. It is confidently expected that with improved business conditions the membership will show a marked increase.

The Chapter has continued to recognize achievement in the field of municipal engineering in the Philadelphia area by presenting medals for meritorious service, at the annual banquet. This year the recipients were:

SETH M. VANLOAN, Chief, Bureau of Water, Philadelphia, Pa.

CHARLES S. SHAUGHNESSY, Chief Examiner, Civil Service Commission, Philadelphia, Pa.

HOWARD K. MINTZER, Supervising Estimator, Bureau of Highways, Philadelphia, Pa.

In order to encourage younger men in the profession, essay prizes were continued this year. The winners who received their award at the Annual Banquet were:

First Prize: JACK DUNN for paper on *The Legal Opening of a Street in Philadelphia, Pa.*

Second Prize: JAMES J. CRATIN for paper on *Slum Areas.*

Honorable Mention: RALPH HAFNER for paper on *An Intersection Classification Method.*

Cooperation with other local organizations was continued through the appointment of contact men. Edward J. Dauner was especially active in this work.

A number of our members enjoyed the opportunity of attending the national convention held at Cincinnati last year and returned with many interesting and instructive reports which were presented at the October meeting.

The success of the year in developing those things for which we are organized is due in no small manner to the interest and activity of our hard working Secretary, Joseph C. Gibbs, and to the members of the Board of Directors. Their cooperation has been most gratifying. Thomas Buckley, Vice-President of the national body, has kept the Chapter in close touch with history-making developments in the national headquarters of the Society.

The election held at the May meeting brought into office men who have been leaders in the Chapter. We look forward to a most interesting and worth while year under the direction of the new President, Samuel S. Baxter.

REPORT OF THE ROCHESTER CHAPTER

As a result of the interest created in Rochester following the first joint meeting of the American Society of Municipal Engineers and the International Association of Public Works Officials in the fall of 1934, the Local Arrangements Committee for this Joint Congress felt that it would be desirable to form a local chapter of these two national associations in Rochester.

With this end in view, a promotion dinner was held at the Hotel Rochester, June 2, 1936, which 52 engineers, as well as public officials interested in the objects of these two societies, attended as guests.

Henry L. Howe, Third Vice-President of the AME, as chairman of the Local Arrangements Committee for the AME, acted as chairman of the meeting following the dinner, being assisted by Edwin A. Miller, Treasurer of the IAPWO and the other members of the Local Arrangements Committee, E. A. Fisher, honorary chairman, AME, Thomas J. Morrison, honorary chairman, IAPWO, Morgan D. Hayes and John V. Lewis. C. Arthur Poole, another member of the Local Arrangements Committee, and the Board of Directors of the AME, was absent from the city.

Following a brief talk by the chairman and by Mr. Miller, Frank W. Herring, Executive Director, addressed the meeting. Following Mr. Herring's talk, an informal vote was taken to determine the interest of the members present in the formation of a local chapter, and Henry L. Howe was elected chairman *pro tem*, after which membership application cards were distributed and signed. A Nominating Committee and tellers were appointed, and the following officers were elected:

President: THOMAS J. MORRISON, Commissioner of Public Works, City of Rochester

First Vice-President: MORGAN D. HAYES, City Engineer, City of Rochester

Second Vice-President: JOHN V. LEWIS, Director, Operation and Maintenance, D. P. W., City of Rochester

Secretary-Treasurer: HENRY L. HOWE, Engineer, Division of Engineering, City of Rochester

Three members of the Executive Committee were also elected, as follows:

MELOY SMITH, Superintendent, Water Division, City of Rochester

EDWIN A. MILLER, Supt. of Maintenance, D. P. W., City of Rochester, N. Y.

KENNETH KNAPP, Assistant Engineer, Division of Engineering, City of Rochester, N. Y.

At its meeting in Toronto the latter part of June 1936, the Joint Board recommended to the Board of Directors of the AME and the Board of Governors of the IAPWO that the application for the establishment of a Rochester Chapter be approved.

A formal application addressed to the members of the Board of Directors of the AME and the Board of Governors of the IAPWO for the establishment of a Rochester Chapter of these organizations was forwarded to the Executive Director September 9, 1936, accompanied by the necessary signed applications and dues for 38 new members which, with the 6 former members, makes a total of 44 charter members for the Rochester Chapter.

On September 21, 1936, the Secretary-Treasurer of the Rochester Chapter received a notification from the Executive Director that a majority of the members of both boards had voted affirmatively upon the establishment of the Rochester Chapter and the by-laws adopted by this organization, and that the Rochester Chapter can consider itself duly approved and established.

While the Rochester Chapter outside of its organization meeting and meetings of the Board of Directors has had no other activities during this year, it is expected it will have a number of interesting meetings during the fall and winter, and is being represented at the Toronto Convention by at least 15 members from Rochester.

REPORT OF CHICAGO CHAPTER

THE Chicago Chapter of the American Society of Municipal Engineers held a meeting on June 21, 1935, to discuss the Public Works Administration program. The meeting was addressed by C. M. Osborn, Acting Illinois State Engineer of the PWA, and later a discussion of the program was led by Loran D. Gayton, City Engineer of Chicago. This meeting followed a dinner at the Chicago Engineers Club, and was attended by 84 members of the Society and others interested in public works.

On April 3, 1936, a dinner and meeting was held at Winnetka, Ill., which was attended by 47. L. R. Howson, retiring President of the Chicago Chapter, led the discussion on "Winter Problems in Public Works." The following officers were elected for the year beginning July 1, 1936:

President: H. J. FIXMER, Chicago, Ill.

Vice-President: ROBERT L. ANDERSON, Winnetka, Ill.

Secretary-Treasurer: HAROLD VAGTBORG, Armour Institute of Technology, Chicago, Ill.

Several meetings are planned for this winter and spring. The first one is scheduled for October, at which time a report on the Toronto Conference will be given by W. W. DeBerard, and a discussion led by President H. J. Fixmer regarding the establishment of regular meeting dates instead of having called meetings. This change appears advisable because of the increased activity and interest in public works.

The Chicago Chapter has a membership of 49, a net gain of four over last year, seven new members, and three lost due to change of location.

The treasury shows a balance of \$294.59.

CONSTITUTION OF THE AMERICAN PUBLIC WORKS ASSOCIATION

I. NAME

The name of the Association shall be "American Public Works Association," and its principal place of business shall be at Chicago, Illinois.

II. PURPOSES

The purposes of the Association shall be the advancement of the theory and practice of the design, construction, maintenance, administration, and operation of public works facilities and services; the dissemination of information and experience upon and the promotion of improved practices in public works administration; the encouragement of the adherence by public works officials to a high professional standard; and the professional and social improvement of its members.

The Association is not organized for profit, and no part of the earnings shall inure to the benefit of any member or officer, except as compensation for services rendered or for necessary expenses actually incurred.

III. MEMBERS

a. *Active*—Any person holding an elective or appointive position on a public body engaged in the field of public works, or being an officer, executive, staff member or consultant to, or a member of the staff of a consultant to, such a body, shall be eligible for Active membership in the Association.

b. *Associate*—Any person having special knowledge, experience or interest in any phase of public works activity shall be eligible for Associate membership.

c. *Senior*—Any member who shall have paid dues continuously for a period of thirty years in the Association and/or the American Society of Municipal Engineers and/or the International Association of Public Works Officials, or who at the time this constitution becomes effective is enrolled as a Senior member of the American Society of Municipal Engineers or as a Life member of the International Association of Public Works Officials, shall be eligible for Senior membership if he so elects and thereafter shall not be required to pay Association dues.

d. *Honorary*—At the recommendation of the Board of Directors and a two-thirds vote of members present at an annual conference, persons may be elected Honorary members of the Association. Those enrolled as Honorary members in the International Association of Public Works Officials at the time this constitution becomes effective shall be continued as Honorary members of this Association.

Only Active and/or Senior members shall be entitled to hold office.

An Active member who retires from official position shall, unless otherwise ordered by the Board of Directors, be retained in his active status.

IV. BOARD OF DIRECTORS AND EXECUTIVE COMMITTEE

The governing body of the Association shall be the Board of Directors, consisting of:

- a. The President, First Vice-President, Second Vice-President, and Treasurer of the Association;
- b. The Chairman of the Administration Division;
- c. The Chairman of the Maintenance and Operation Division;
- d. The Chairman of the Design and Construction Division;
- e. Four Active or Senior members of the Association at-large elected at the 1937 annual meeting for terms of one, two, three and four years respectively, whose successors shall be elected for a term of four years;
- f. The last living Past-President of the Association;
- g. Four members of the American Society of Municipal Engineers elected by the Board of Directors of that organization at the 1936 Public Works Congress to serve from January 1, 1937, until the 1937 annual meeting of the Association;
- h. Four members of the International Association of Public Works Officials elected by the Board of Governors of that organization at the 1936 Public Works Congress to serve from January 1, 1937, until the 1937 annual meeting of the Association.

The Board of Directors shall be responsible to the membership for the management of the affairs of the Association, and for the promotion of the Association's purposes. It shall have the power of enacting, by a majority vote, such By-Laws as are necessary for the government of the Association.

An Executive Committee, consisting of the last living Past-President, the President, the First Vice-President, the Second Vice-President, and the Treasurer of the Association, shall have the power to exercise all the functions of the Board of Directors between annual meetings and when the Board is not in session.

In the event of a vacancy upon the Board of Directors, the remaining members of the Board shall have power to elect an Active or Senior member to fill the vacancy, to serve until the next annual meeting of members.

V. OFFICERS

The officers of the Association shall be a President, a First Vice-President, a Second Vice-President, and a Treasurer, who shall be Active and/or Senior members elected by letter ballot of the members of the International Association of Public Works Officials and the American Society of Municipal Engineers to serve from January 1, 1937, until the 1937 annual meeting of the Association, and whose successors shall be Active and/or Senior members elected by the members of the Association at the annual meeting for a term of one year.

The Board of Directors shall select an Executive Director and such employees as they may deem proper, to serve at their pleasure, and shall fix their compensation.

In the event of a vacancy occurring in the office of President, the unexpired term shall be filled by the First Vice-President, to be succeeded by the Second Vice-President. In the event of a vacancy occurring in the office of Treasurer, the Board of Directors shall select an Active or Senior member to fill the unexpired term.

VI. DUTIES OF OFFICERS

- a. The President shall act as Chairman of the Board of Directors and of the Executive Committee, and shall preside at meetings of the members, except as otherwise ordered by the Board. He shall appoint such standing or special

committees as he shall consider necessary or as instructed by the Board of Directors, and shall be, ex-officio, a member of such committees. He shall be responsible to the Board of Directors for the functioning of these committees. He shall sign on behalf of the Association all deeds, contracts and other formal instruments, and shall perform such other duties as may from time to time be assigned to him by the Board of Directors.

b. The Vice-Presidents shall, during the absence of the President or his inability to act, have and exercise all his powers and duties, and shall also perform such other duties as may from time to time be assigned to them by the Board of Directors.

c. The Treasurer shall be the chief financial agent of the Association, and shall exercise authority in all financial matters in accordance with such by-laws and resolutions as may be adopted by the Board of Directors. The Executive Director shall furnish the Treasurer with such financial statements as he may require. The Treasurer shall have the custody of all funds and securities of the Association, including all bonds, stocks, deeds, and other documents, and to this end he may determine the manner of depositing and safe-keeping of the funds and securities of the Association and the system of financial records. The Board of Directors shall fix the amount of the bond to be furnished by the Treasurer, the cost of such bond to be borne by the Association.

d. The Executive Director shall be in charge of the general management of the affairs of the Association subject to this constitution and such regulations as may be adopted by the Board of Directors. He shall collect all fees and other moneys owing to the Association and shall deposit them to the credit of the Association; he shall annually prepare a budget for the Association and upon its approval by the Board of Directors shall have authority to expend the sums appropriated; he shall keep a complete record of all his receipts and expenditures, which shall annually be audited by a firm of certified public accountants and the report submitted to the Board of Directors; he shall give bond in such form and amount as may be determined by the Board of Directors, the cost of such bond to be borne by the Association. He may appoint and discharge any employees or subordinates, and shall fix their compensation within such limits as may be provided by the budget, and may make agreements on behalf of the Association in performing the duties entrusted to him. He shall act as Secretary of the Association, shall conduct its correspondence, shall give notice of and keep minutes of all meetings, and shall have custody of the records of the Association and of the corporate seal, and shall attest all instruments. He shall perform such other duties as may be assigned to him by the President and the Board of Directors.

VII. MEETINGS

An annual meeting of the members of the Association shall be held at a time and place to be determined by the Board of Directors. Special meetings shall be held on the call of the President or the Board of Directors, or upon the request in writing of any one hundred and twenty-five Active and/or Senior members. Such special meetings shall be held within thirty days of the receipt of request. The Board of Directors shall have its annual meeting immediately following the annual meeting of the members. Special meetings of the Board of Directors or of the Executive Committee shall be held on the call of the President or on the request in writing of any three members of the Board or Committee.

At least five days' notice of the time, place, and purpose of all meetings shall be given to all persons entitled to notice thereof. Such notice may be given by mail or telegram to the last known address of the person, or personally.

VIII. QUORUM

A majority of the Board of Directors shall constitute a quorum thereof. A quorum of the Executive Committee shall be three members. Twenty members shall constitute a quorum to do business at a meeting of members.

IX. DUES

The annual dues for Active and Associate members shall be as determined from time to time by the Board of Directors, subject to the approval of the membership. Non-payment of dues for two years shall be treated as equivalent to resignation, unless otherwise provided by the Board of Directors, and the name of the member shall be removed from the rolls of the Association, provided at least four weeks' notice is given, during which time he may discharge his obligations and have his membership continued.

X. NOMINATIONS

A Nominating Committee, composed of two members of the International Association of Public Works Officials selected by the Board of Governors of that organization at the 1936 Public Works Congress and two members of the American Society of Municipal Engineers selected by the Board of Directors of that organization at the 1936 Public Works Congress, shall propose the names of candidates for President, First Vice-President, Second Vice-President, and Treasurer to serve from January 1, 1937, until the 1937 annual meeting.

The President, with the approval of the Board of Directors, shall thereafter appoint each year a Nominating Committee of five Active and/or Senior members, which shall propose the names of candidates for all officers and directors-at-large to be voted upon at the annual meeting. Additional nominations may be made from the floor at the annual meeting by any Active member.

XI. DIVISIONS

There shall be three Divisions to provide for the specialized interests of the members of the Association: The Administrative Division, the Design and Construction Division, and the Maintenance and Operation Division. A member of the Association may register in any one or more of the Divisions. Each Division shall be presided over by a Chairman, who shall be elected at the annual meeting by the members registered in that Division. The same person shall not serve as Chairman continuously of the same Division in excess of two years.

The three Divisions shall be managed in conformity with the constitution of the Association and the rules established by the Board of Directors.

XII. CHAPTERS

The Association shall encourage and recognize the establishment of regional, state and local chapters of its members, the purposes of which shall be the furtherance of the objectives of the Association in the region, state or locality. Applica-

tions for the establishment of a chapter, together with a copy of the proposed chapter by-laws and a list of those who have agreed to become members of the chapter, shall be submitted to the Board of Directors for approval. Upon notice of approval given by the Board, the chapter shall be considered established.

All chapters shall be managed in conformity with the constitution of the Association and the rules established by the Board of Directors.

XIII. SEAL

The Association shall have a seal which shall bear the legend "American Public Works Association," and the year of incorporation.

XIV. WAIVER OF NOTICE AND ACTION WITHOUT MEETING

Any person entitled to vote at any meeting of members, or of the Board of Directors, or of the Executive Committee, may waive notice of the time, place, and purpose of such meeting either before or after the date of such meeting, and any action taken or resolution adopted thereat shall, upon such waiver, be as valid as though notice had been given.

Any action or resolution which might be taken or adopted at any meeting of the Board of Directors, Executive Committee, or members, shall be valid if written memorandum of such action or resolution is duly served upon all persons entitled to vote thereon in the manner prescribed for notice of a meeting, and if such action or resolution is approved in writing by a majority of the persons entitled to vote thereon.

XV. AMENDMENTS

Proposed amendments to this constitution must be submitted to the Board of Directors in writing, signed by not less than twenty-five Active and/or Senior members. If the proposed amendment is approved by the Board of Directors, it shall be submitted to the membership for letter ballot. An affirmative vote of two-thirds of the qualified votes cast shall be necessary for the adoption of a proposed amendment.

ASSOCIATION COMMITTEES *

COMMITTEE ON CITY AND REGIONAL PLANNING

- FREDRICK R. STORRER, *Chairman*, City Engineer, Municipal Bldg., Dearborn, Mich.
THOMAS BUCKLEY, Assistant Chief Engineer and Surveyor, Bureau of Engineering, Surveys and Zoning, 1102 City Hall Annex, Philadelphia, Pa.
WALTER A. HEIMBUECHER, City Engineer, City Hall, University City, Mo.
S. C. JACKA, City Engineer, City Hall, Lansing, Mich.
THOMAS F. LAWLOR, Consulting Engineer and Superintendent of Public Works, 140 S. Cherry St., Poughkeepsie, N. Y.
RALPH G. LINGLEY, City Engineer, 33 City Hall, Worcester, Mass.
NATHANIEL L. MARKS, JR., City Engineer, 21 City Hall, New Orleans, La.
JOSEPH P. SCHWADA, City Engineer, City Hall, Milwaukee, Wis.
W. E. SHEDDAN, City Engineer, City Engineers Bldg., Jacksonville, Fla.
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COMMITTEE ON MUNICIPAL FIELD ENGINEERING

- WALTER STARKWEATHER, *Chairman*, Technical Assistant Engineer, U. S. Coast Guard, 2131 Massachusetts Ave., N. W., Washington, D. C.
B. L. CROZIER, Chief Engineer, Dept. of Public Works, 2721 St. Paul St., Baltimore, Md.
HERBERT M. DIBERT, Secretary and Treasurer, W. & L. E. Gurley, 514 Fulton St., Troy, N. Y.
MURRAY Y. POLING, 1500 Eye St., N. W., Washington, D. C.
FREDERICK THOMAS THORPE, JR., Surveyor and Regulator, 1129 Sanger St., Frankford, Philadelphia, Pa.
ARTHUR L. VEDDER, Superintendent of Surveys, Dept. of Public Works, 52 City Hall, Rochester, N. Y.
B. B. WEBER, City Engineer, City Hall, Oil City, Pa.
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COMMITTEE ON STREET PAVING, CONSTRUCTION DESIGN AND MAINTENANCE

- GEORGE H. SANDENBURGH, *Chairman*, City Engineer, City Hall, Ann Arbor, Mich.
ARVID ANTON ANDERSON, Manager, Highways and Municipal Bureau, Portland Cement Assn., 33 W. Grand Ave., Chicago, Ill.
JULIAN G. BAILEY, Division Engineer, Bureau of Engineering, Surveys and Zoning, 266 S. 58th St., Philadelphia, Pa.
ROBERT B. BROOKS, Consulting Engineer, 1517 Mart Bldg., St. Louis, Mo.
W. L. HEMPELMAN, Engineer, Asphalt Sales Dept., The Texas Co., 332 S. Michigan Ave., Chicago, Ill.
H. W. JOHNSTON, City Engineer, City Hall, Halifax, Nova Scotia, Can.
GEORGE F. SCHLESINGER, Chief Engineer and Managing Director, National Paving Brick Assn., National Press Bldg., Washington, D. C.

* As appointed January, 1937.

WILLIAM B. SHAFER, Superintendent of Highways and Sewers, City-County Bldg., Pittsburgh, Pa.

COMMITTEE ON LIGHTING AND PUBLIC SAFETY

- PAUL HOMER GOODELL, *Chairman*, Street Lighting Engineer, General Illumination Engineering Co., 3605-07 Carew Tower, Cincinnati, Ohio
W. T. BLACKWELL, General Lighting Representative, Public Service Electric & Gas Co., 80 Park Place, Newark, N. J.
S. C. LOVETT, Bureau of Light, City-County Bldg., Pittsburgh, Pa.
THEODORE M. MATSON, Traffic Survey, 40 First Street, San Francisco, Calif.
NELSON I. RAYMOND, 610 Pine St., Owosso, Mich.
KIRK M. REID, Illuminating Engineer, Nela Park Engineering Dept., General Electric Co., Cleveland, Ohio
PETER J. STUPKA, Research Engineer, Highway Research Board, 2125 G. St., N. W., Washington, D. C.
STUART R. WILLIAMS, Manager, Street Lighting Department, Holophane Co., Newark, Ohio
L. A. S. WOOD, Chief Lighting Engineer, Westinghouse Electric & Mfg. Co., 30 Rockefeller Plaza, New York, N. Y.
-

COMMITTEE ON TRAFFIC CONTROL

- BURTON W. MARSH, *Chairman*, Director, Safety and Traffic Engineering Dept., American Automobile Assn., Pennsylvania Ave. at 17th St., Washington, D. C.
LEWIS V. BULLIS, Chief, Traffic Survey Division, Coordinating Committee of the Central Statistical Board & WPA, 1630 R. St., N. W., Apt. 734, Washington, D. C.
MAXWELL HALSEY, Assistant Director, Bureau for Street Traffic Research, Harvard University, Cambridge, Mass.
FRANK J. McDEVITT, Director, Streets and Sewers, City Hall, St. Louis, Mo.
THEODORE M. MATSON, Traffic Survey, 40 First St., San Francisco, Calif.
ROBERT A. MITCHELL, Traffic Engineer, Dept. of Public Safety, 790 City Hall, Philadelphia, Pa.
A. J. NAQUIN, Transportation Engineer, New Orleans Public Service, Inc., 317 Baronne St., New Orleans, La.
EARL J. REEDER, Traffic Engineer, National Safety Council, 20 N. Wacker Drive, Chicago, Ill.
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COMMITTEE ON STREET CLEANING

- JOHN S. FLOCKHART, *Chairman*, Principal Assistant Engineer, Bureau of Street Cleaning, City Hall, Newark, N. J.
HAROLD D. BRADLEY, Street Commissioner, 90 Albert St., Toronto, Ontario, Can.
WILLIAM J. GALLIGAN, Assistant Superintendent, Bureau of Streets, 2840 S. Calumet Ave., Chicago, Ill.
JOSEPH E. GILL, Supervising Engineer, Dept. of Public Works, Penn Athletic Club, 18th and Locust Sts., Philadelphia, Pa.

- ALFRED E. ROCHE, Division Engineer, WPA, 1604 Peoples Ave., Troy, N. Y.
WILLIAM B. SHAFER, Superintendent of Highways and Sewers, City-County Bldg., Pittsburgh, Pa.
WILLIAM ALBERT XANTEN, Supervisor, City Refuse Division, Engineering Dept., District Bldg., Washington, D. C.
-

COMMITTEE ON SEWERAGE AND SANITATION

- DARWIN W. TOWNSEND, *Chairman*, Consulting Engineer, Consoer, Townsend and Quinlan, 757 N. Broadway, Milwaukee, Wis.
HARRY M. BEAUMONT, Supervising Engineer, WPA, 480 Martin St., Philadelphia, Pa.
CARL B. CARPENTER, Superintendent, Dept. of Sewerage and Sanitation, City Hall, Bloomington, Ind.
JAMES L. FEREBEE, Chief Engineer, City Sewerage Comm. and County Metropolitan Sewerage Comm., Box 2079, Milwaukee, Wis.
JOHN B. HAWLEY, Consulting Civil Engineer, Hawley, Freese and Nichols, 407 Capps Bldg., Ft. Worth, Tex.
CLARENCE E. KEEFER, Principal Assistant to Sewerage Engineer, 2030 Park Ave., Baltimore, Md.
ALBERT P. LEARNED, Assistant Engineer, Black and Veatch, 4706 Broadway, Kansas City, Mo.
MARK B. OWEN, Vice-President, Nichols Engineering and Research Corp. of New York, 7752 Kentucky Ave., Dearborn, Mich.
WILLIAM M. PIATT, Consulting Engineer, 400 Depositors National Bank Bldg., Durham, N. C.
RUSSELL W. RAGSDALE, Resident Engineer Inspector, PWA, Arnett, Okla.
THORNDIKE SAVILLE, Associate Dean and Professor of Hydraulic Sanitary Engineering, New York University, Box 65, University Heights, New York, N. Y.
-

COMMITTEE ON REFUSE COLLECTION AND DISPOSAL

- CARL SCHNEIDER, *Chairman*, Senior Engineer, WPA, 1734 New York Ave., Washington, D. C.
H. B. BLECK, Public Engineer, City Hall, Waukegan, Ill.
H. J. CATES, Chief, Sanitary Department, 603 City Hall, Atlanta, Ga.
DAVID W. GODAT, Maintenance Engineer, Dept. of Public Works, 18 City Hall, New Orleans, La.
SAMUEL A. GREELEY, Greeley & Hansen, Consulting Engineers, Suite 1710, 6 N. Michigan Ave., Chicago, Ill.
MORRIS LAPHEN, District Superintendent, Bureau of Streets, 2840 S. Calumet Ave., Chicago, Ill.
GEORGE E. LEAKE, Superintendent of Streets, 208 S. Racine Ave., Chicago, Ill.
JOHN V. LEWIS, Director of Maintenance and Operation, Dept. of Public Works, 54 Court St., Rochester, N. Y.
WILLIAM SYDOW, Director, Public Service, City Hall, Miami, Fla.
G. E. TAYLOR, Deputy Street Commissioner, 90 Albert St., Toronto, Ontario.
RALPH C. TAYLOR, Assistant Superintendent, Waste Collection Division, 648 Probasco Ave., Cincinnati, Ohio

WILBUR H. WINSHIP, Assistant Superintendent, Dept. of Sanitation, 1020 Sanders St., Indianapolis, Ind.

COMMITTEE ON WATER WORKS

L. R. HOWSON, *Chairman*, Consulting Engineer, Alvord, Burdick & Howson, 20 N. Wacker Drive, Chicago, Ill.

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D. L. ERICKSON, City Engineer, City Hall, Lincoln, Nebr.

WALTER A. PEIRCE, Manager, Water Dept., City Hall, Racine, Wis.

WESLEY W. POLK, Superintendent and Chief Engineer, Water Dept., Sheridan and Lincoln Sts., Evanston, Ill.

WILLIAM SYDOW, Director, Public Service, City Hall, Miami, Fla.

ALFRED F. THEARD, General Superintendent, Sewerage and Water Board, Sewerage and Water Board Bldg., New Orleans, La.

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COMMITTEE ON PUBLIC UTILITIES

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JOHN CAMPBELL, Superintendent, Special Service Dept., Edison Electric Illuminating Co., 182 Tremont St., Boston, Mass.

FRED A. EEARHART, Commissioner of Public Utilities, City Hall, New Orleans, La.

EDGAR DOW GILMAN, Director of Public Utilities, City Hall, Cincinnati, Ohio

EDGAR B. HESS, City Engineer, Director of Public Service, 183 Plum St., Chillicothe, Ohio

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COMMITTEE ON AIRPORTS AND LANDING FIELDS

ROBERT S. HEDTLER, *Chairman*, Consulting Engineer for Aeronautics, 2506 S. Lambert St., Philadelphia, Pa.

VICTOR DALLIN, President, Dallin Aerial Surveys, 651 Fern St., Lansdowne, Pa.

PERRY A. FELLOWS, Assistant Chief Engineer, WPA, 1937, 38th St., Washington, D. C.

- HARRY GOODRIDGE, City Engineer and Superintendent of Streets, City Hall, Berkeley, Calif.
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W. H. ROBERTS, Assistant Engineer, Dept. of Public Works, 230 City Hall Annex, Rochester, N. Y.
HOWARD M. SHAFER, Airport Manager, Department of Public Works, 34 Court St., Rochester, N. Y.
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SPECIFICATIONS COMMITTEE ON SEWERS

- EDWIN R. SCHOFIELD, *Chairman*, Division Engineer, Bureau of Engineering, Surveys & Zoning, 616 E. Leverington Ave., Philadelphia, Pa.
GUY BROWN, Engineer, Sewer Design, City Hall, St. Louis, Mo.
HARRY EUSTANCE, City Engineer, City Hall, Ithaca, N. Y.
CARL L. HOWELL, Assistant Engineer, 502 City Hall, Buffalo, N. Y.
MERVIN H. KOHLER, Assistant Engineer, Bureau of Engineering, Surveys and Zoning, Rm. 1232, City Hall Annex, Philadelphia, Pa.
M. W. LOVING, Secretary, American Concrete Pipe Assn., 33 West Grand Ave., Chicago, Ill.
J. W. NEMOYER, Assistant Engineer, Greeley & Hansen, 6 N. Michigan Ave., Chicago, Ill.
JOHN M. POWELL, City Engineer, City Hall, Elyria, Ohio
GEORGE M. SHEPARD, Chief Engineer, Dept. of Public Works, 234 City Hall, St. Paul, Minn.
-

SPECIFICATIONS COMMITTEE ON SUBGRADE
AND FOUNDATIONS

- WALTER E. ROSENGARTEN, *Chairman*, Lower Merion Township Engineer, Township Bldg., Ardmore, Pa.
E. R. DUTTON, Paving Engineer, 3240 Dupont Ave., S., Minneapolis, Minn.
D. L. ERICKSON, City Engineer, City Hall, Lincoln, Nebr.
CHARLES N. FORREST, Technical Adviser, Barber Asphalt Co., 1600 Arch St., Philadelphia, Pa.
HARRY GOODRIDGE, City Engineer and Superintendent of Streets, City Hall, Berkeley, Calif.
WILLIAM A. HANSELL, Assistant Chief of Construction and Engineer of Sewers, 737 Woodland Ave., S. E., Atlanta, Ga.
GEORGE E. HESSELBACHER, Township Engineer, 8200 Fairview Road, Elkins Park, Pa.
HENRY L. HOWE, Mechanical and Electrical Engineer, Civil Engineer, Division of Engineering, 52 City Hall, Rochester, N. Y.
CLARENCE D. POLLOCK, Consulting Engineer, 1716 Park Row Bldg., New York, N. Y.
WILLIS R. TENNEY, Consulting Engineer, 1049 E. 18th St., Brooklyn, N. Y.

SPECIFICATIONS COMMITTEE ON BITUMINOUS PAVEMENTS

- H. F. CLEMMER, *Chairman*, Engineer of Materials, District Bldg., Washington, D. C.
JULIUS ADLER, Consulting Engineer, 2001 Architects Bldg., 17th & Sansom Sts., Philadelphia, Pa.
GEORGE W. ANDRESS, Engineer in Charge, Bureau of Streets, City Hall, Newark, N. J.
A. W. DOW, Vice-President and Chief Engineer, Colprovia Roads, Inc., 801 Second Ave., New York, N. Y.
A. T. GOLDBECK, Director, Bureau of Engineering, National Crushed Stone Assn., Inc., Munsey Bldg., Washington, D. C.
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Committee C-6 on Drain Pipe Specifications (Sectional Com. A6—1925 A. S. A.)	E. S. RANKIN
Committee C-13 on Concrete Pipe	E. S. RANKIN
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Committee on Street Lighting	ELLSWORTH FRANCISCO
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Conference on Proposed Code of Good Practice for Brick Masonry Work (Sectional Com. A-41)	ROY L. PHILLIPS

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The following alphabetical list contains the names of all the members of the American Public Works Association. The date in parentheses indicates the year of member's affiliation. The membership classification is active unless (Assoc.) Associate, Senior, Life or Honorary membership is indicated.

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- Aloff, Abraham M.** (1933) Civil Service Examiner, Room 152, State House, Boston, Mass.
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- Anderson, A. M.** (Life-1920) Treas., Elgin Corp., 100 N. LaSalle St., Chicago, Ill.
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- Baldry, William Ernest** (1918) Asst. Chief Engr., Kansas Emergency Relief Comm., 1206 W. 13th St., Topeka, Kans.

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- Ballantyne, George (1928) Commr. of Public Works, City Hall, Syracuse, N. Y.
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- Barbour, Frank A. (1914) Cons. Engr., 1119 Tremont Bldg., Boston, Mass.
- Barbour, J. G. (Assoc.-1911) Secy.-Treas., Metropolitan Paving Brick Co., Canton, Ohio.
- Bareuther, Charles A. (1932) Engr. Examiner, Civil Service Comm., 975 City Hall, Philadelphia, Pa.
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- Barrett, Andrew E. (1931) Construction, Technical & Designing Engr., Busman Mfg. Co., 4355 Forest Park Blvd., St. Louis, Mo.
- Barth, J. Arthur (1937) Managing Clerk, Water Works Dept., 14 City Hall, Rochester, N. Y.
- Bartholomew, Tracy (1930) Mgr., Research & Tests, Duquesne Slag Products Co., 808 Diamond Bank Bldg., Pittsburgh, Pa.
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- Baylis, J. R. (1911) Physical Chemist, Bureau of Engrg., 1643 E. 86th St., Chicago, Ill.
- Beacham, J. G. (1932) Supt. Water Works, City Engr., City Hall, Athens, Ga.
- Beaumont, Harry M. (1929) Supervising Engr., WPA, 480 Martin St., Philadelphia, Pa.
- Beebe, Harwood (1925) Cons. Engr., 208 Montgomery Bldg., Spartanburg, S. C.
- Beers, W. D. (1935) City Engr., 401 City & County Bldg., Salt Lake City, Utah.
- Beesley, Richard (1932) Second Asst. Surveyor, 439 E. Washington Lane, Philadelphia, Pa.
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- Bieker, Lawrence W. (1937) Structural Engr., United Boiler Heating & Foundry Co., 254-167th St., Hammond, Ind.
- Biery, John M. (1936) City Engr., City Offices, Jackson, Mich.
- Biggins, J. C. (1932) City Mgr., City Hall, Newport News, Va.

- Bigler, Hugh P.** (1932) Director, Rail Steel Bar Assn, 228 N. LaSalle St., Chicago, Ill.
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- Biser, D. Benton** (1930) Director & Secy., Comm. on Governmental Efficiency & Economy, Inc., Mercantile Trust Bldg, Baltimore, Md.
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- Blanchard, Arthur H.** (1909) Cons. Highway Engr. and Traffic Control and Transport Consultant, Box C, Edgewood Station, Providence, R. I.
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- Bowles, J. D.** (1923) c/o Hotel Savoy, 9th & Central Sts., Kansas City, Mo.
- Boye, B. L.** (Assoc.-1936) Mgr., Asphalt Dept., Socony-Vacuum Oil Co., Inc., 26 Broadway, New York, N. Y.
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- Covas, Perfecto A. (1937) Engr. Computer, Dept. of Engrg., 52 City Hall, Rochester, N. Y.
- Cowden, E. C. (1916) City Engr., City Hall, Harrisburg, Pa.
- Craig, J. Russell (Assoc.-1933) Safety Director, J. A. Montgomery Inc., DuPont Bldg., Wilmington, Del.
- Cramer, Harry P. (Assoc.-1937) Sales Engr., The Shelt Co., 241 Fair Oaks Ave., Rochester, N. Y.
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- Dibert, Herbert M. (1923) Secy.-Treas., W. & L. E. Gurley, 514 Fulton St., Troy, N. Y.
- Diel, Charles H. (Assoc.-1931) F19 Railway Exchange Bldg, St. Louis, Mo.
- Dillon, James F. (1932) Transitman, Bureau of Engrg., Surveys and Zoning, 436 Carpenter Lane, Germantown, Philadelphia, Pa.
- Dingle, James H. (1908) City Engr., City Hall, Charleston, S. C.
- Dodge, James Lynn (1929) 6127 Ellsworth St., Philadelphia, Pa.
- Dolge, Henry D. (1930) Street Sanitation Supervisor and Foreman, 2154 N. 60th St., Milwaukee, Wis.
- Donelson, J. E. (Assoc.-1929) Supt., Sloss Sheffield Steel & Iron Co., 1321 N. 21st St., Birmingham, Ala.
- Donnelley, L. S. (1937) Engr., Hokianga County, P. O. Box 3, Rawene, N. Z.
- Donnelly, Arthur J. (1932) 5453 N. 11th St., Philadelphia, Pa.
- Donohue, Jerry (1926) President, Jerry Donohue Engrg. Co., 608 N. 8th St., Sheboygan, Wis.
- Doremus, Goline (1920) Deputy Chief Engr., Dept. Public Affairs, City Hall, Newark, N. J.
- Dorn, William Howard (1932) First Asst. Surveyor, 11 North 50th St., Philadelphia, Pa.
- Douglass, Robert M. (1931) Civil & Sanitary Engr., 912 Columbia Bank Bldg., Pittsburgh, Pa.
- Dow, A. W. (Senior-1899) Vice President & Chief Engr., Colprovia Roads, Inc., 801 Second Ave., New York, N. Y.
- Doyle, Roscoe C. (1935) District Project Auditor, PWA, Room 1441-20 North Wacker Drive, Chicago, Ill.
- Drake, W. O. (1921) City Engr. & Supt., Dept. of Public Works, City Hall, Corning, N. Y.
- Drew, Howard Stebbin (1935) Field Repres., WPA, Rm. 2220 Merchandise Mart, Chicago, Ill.
- Dunn, F. B. (Assoc.-1931) 309 Monroe St., Conneaut, Ohio.
- Durham, Henry Welles (1913) Supt. of Development, Resettlement Administration, Sandwich, Mass.
- Dutton, E. R. (1914) Paving Engr., 3240 Dupont Ave., S., Minneapolis, Minn.
- Earhart, Fred A. (1930) Commr. of Public Utilities, City Hall, New Orleans, La.
- Earl, George G. (Senior-1906) Cons. Engr., Earl Engineering Co., Whitney Bank Bldg., New Orleans, La.
- Eckert, Alfred (1936) Director of Public Works, 3 Jefferson Court, Saginaw, Mich.

- Eddy, Dudley B. (1934) Chairman, Board of Public Works, County-City Bldg., Seattle, Wash.
- Eddy, Harrison P. (1914) Metcalf & Eddy, 1300 Statler Bldg., Boston, Mass.
- Eddy, Harrison P., Jr. (1930) Cons. Engr., Metcalf & Eddy, 1300 Statler Bldg., Boston, Mass.
- Elgin Corporation, The (Assoc.-1932) 501 Fifth Ave., New York, N. Y.
- Elgin Sweeper Company (Assoc.-1932) 5 Oak St., Elgin, Ill.
- Ellis, Remington (1937) Junior Asst. Engr., Dept. of Engrg., 486 S. Goodman St., Rochester, N. Y.
- Ellis, William B. (1935) Route 2, Box 500, San Diego, Calif.
- Emerson, C. A., Jr. (1917) Geo. B. Gascoigne & Associates, Woolworth Bldg., New York, N. Y.
- Engle, Amos B. (1929) Surveyor & Regulator, 10th District, 6000 Rising Sun Ave., Philadelphia, Pa.
- Enslow, Linn H. (1931) Vice President & Editor, "Water Works & Sewerage," 155 E. 44th St., New York, N. Y.
- Erickson, D. L. (1926) City Engr., City Hall, Lincoln, Nebr.
- Erickson, Dewey Henry (1935) Procurement Clerk, WPA, Morris, Minn.
- Eschbach, Russel S. (1931) 5244 Ridge Ave., St. Louis, Mo.
- Eschenfelder, Andrew F. (1930) Borough Engr., 6 Herman St., Glen Ridge, N. J.
- Estes, James R. (1936) Asst. City Engr., City Hall, Hattiesburg, Miss.
- Ettinger, L. J., Jr. (Assoc.-1935) Chief Engr., Eastern Division, International Salt Co., Box 36, Ithaca, N. Y.
- Eustance, Harry (1932) City Engr., City Hall, Ithaca, N. Y.
- Evans, Miles E. (1937) Director of Public Service, 227 City Hall, Cleveland, Ohio.
- Everett, Chester M. (1932) Fuller & Everett, 22 E. 40th St., New York, N. Y.
- Fahy, Charles A. (1931) Surveyor, 1115 Kenwyn St., Philadelphia, Pa.
- Faile, Edward Hall (1934) Cons Engr., 608 Fifth Ave., New York, N. Y.
- Farmer, Homer G. (1937) Technical Service Director, Universal Atlas Cement Co., 208 S. LaSalle St., Chicago, Ill.
- Farnham, Arthur B. (1931) Commr. of Public Works & City Engr., Pittsfield, Mass.
- Farwell, Carroll A. (1928) Fay, Spofford & Thorndike, 11 Beacon St., Boston, Mass.
- Faust, Raymond M. (1932) 4611 N. Broad St., Philadelphia, Pa.
- Felch, Harold E. (1937) Asst. Engr., 270 Terrace Park, Rochester, N. Y.
- Fellows, Perry A. (1927) Asst. Chief Engr., WPA, 1937 38th St., Washington, D. C.
- Ferebee, James L. (1921) Chief Engr. of City Sewerage Comm. & County Metropolitan Sewerage Comm., Box 2079, Milwaukee, Wis.
- Ferguson, W. C. (Assoc.-1926) President, Presstite Engineering Co., 3900 Chouteau Ave., St. Louis, Mo.
- Feuchter, Joseph J. (1934) Efficiency Engr., Dept. of Streets & Sewers, City Hall, St. Louis, Mo.
- Fisch, Fred W. (1935) Sanitary Engr., 205 City Hall, Schenectady, N. Y.

- Fischer, A. C. (Assoc.-1925) President, Serviced Products Corp., 6051 W. 65th St., Chicago, Ill.
- Fisher, E. A. (1917) City Engr., City Hall, Lakewood, Ohio.
- Fisher, Edwin A. (Senior-1897) Cons. Engr., 30 Albermarle St., Rochester, N. Y.
- Fisher, Harry L. (1933) City Engr., City Hall, Mobile, Ala.
- Fisher, Philip S. (1930) Chief Clerk, Bureau of Engrg., Surveys & Zoning, 1103 City Hall Annex, Philadelphia, Pa.
- Fisk, George F. (1916) Cons. Engr., 829 Bird Ave., Buffalo, N. Y.
- Fitzpatrick, F. Stuart (Assoc.-1935) Mgr., Construction & Civic Development Dept., U. S. Chamber of Commerce, 1615 H St., N. W., Washington, D. C.
- Fixmer, Hugh J. (1932) Division Engr., Board of Local Improvements, 2533 N. Bernard St., Chicago, Ill.
- Flockhart, John S. (1930) Principal Asst. Engr., Bureau of Street Cleaning, City Hall, Newark, N. J.
- Flood, Walter H. (1918) Cons. Chemical Engr., Roads and Pavements, 822 E. 42nd St., Chicago, Ill.
- Folwell, A. Prescott (Senior-1901) Editor, Public Works, 310 E. 45th St., New York, N. Y.
- Foreman, Herbert E. (1931) Asst. Managing Director, Associated General Contractors of America, Munsey Bldg., Washington, D. C.
- Forrest, Charles N. (1913) Technical Adviser, Barber Asphalt Co., 1600 Arch St., Philadelphia, Pa.
- Fowler, W. S. (1926) Supt. of Sanitation, 2426 Chestnut St., Long Beach, Calif.
- Frantz, Louis T. (1932) Electric Engr., Sewerage & Water Board, 526 Carondelet St., New Orleans, La.
- Friel, Francis S. (1926) Albright & Friel, Inc., 246 S. 15th St., Philadelphia, Pa.
- Frohock, Lawrence W. (1931) Junior Administrative Asst., Civilian Conservation Corps, Palmyra, Mo.
- Fruehauf Trailer Company (Assoc.-1927) 10940 Harper Ave., Detroit, Mich.
- Funk, C. S. (1932) Surveyor, Bureau of Engrg., Surveys and Zoning, 8031 Frankford Ave., Philadelphia, Pa.
- Gage, Robert B. (1920) Chemical Engr., New Jersey State Highway Lab., P. O. Box 199, Trenton, N. J.
- Gaidry, Harold L. (1932) Chief Engr., Gas Dept., New Orleans Public Service, Inc., 317 Baronne St., New Orleans, La.
- Galligan, William J. (1920) Asst. Supt., Bureau of Streets, 2840 S. Calumet Ave., Chicago, Ill.
- Gammie, Tom G. (1936) Exec. Secy., Okla. State Planning Bd., State Capitol, Okla. City, Okla.
- Gans, Roy C. (1934) Chief Engr., Dept. of Streets and Sewers, City Hall, St. Louis, Mo.
- Gardiner, Lion (1925) Vice-President, Jaeger Machine Co., 560 Spring St., Columbus, Ohio.
- Gardner, Clarke (1937) City Engr., City Hall, Salisbury, Md.
- Garrett, J. M. (1935) City Engr., 120 Catoma St., Montgomery, Ala.

- Garrett, Roy Stuart (1935) Asst. City Engr., City Hall, Montgomery, Ala.
- Gascoigne, George B. (1922) Cons. Sanitary Engr., 1140 Leader Bldg., Cleveland, Ohio.
- Gearen, M. C. (1929) Bridge Engr., Dept. of Public Works, 300 Cliff Ave., Racine, Wis.
- George, M. W. (1932) Rodman, Bureau of Engrg., Surveys and Zoning, 212 North 10th St., Philadelphia, Pa.
- Gerlach, Edward H. (1929) Supt., Garbage Collection and Disposal, 3408 N. 49th St., Milwaukee, Wis.
- Gettelman, Fred, Company (Assoc.-1928) High Speed Snow Plows, 4400 State St., Milwaukee, Wis.
- Gibbs, Joseph C. (1931) Surveyor, Bureau of Engrg., Surveys and Zoning, 7236 Elmwood Ave., Philadelphia, Pa.
- Giesey, Jesse K. (1922) Resident Engr., Greeley & Hansen, 31 Lowell Rd., Kenmore, N. Y.
- Gill, Corrington (1935) Asst. Administrator, WPA, 1734 New York Ave., Washington, D. C.
- Gill, J. Francis (1928) Commr. of Public Works, City Hall, Oswego, N. Y.
- Gill, Joseph E. (1932) Supervising Engr., Dept. of Public Works, Penn Athletic Club, 18th and Locust Sts., Philadelphia, Pa.
- Gillett, L. A. (1935) District Director, WPA, 1316 Pendleton St., Cincinnati, Ohio.
- Gillette, Edward H. (Assoc.-1932) 2511 N. 19th St., Philadelphia, Pa.
- Ginnity, William H. (1937) Asst. Engr., 226 City Hall Annex, Rochester, N. Y.
- Glynn, James M. (1933) 217 Belmont Rd., Reno, Nev.
- Godat, David W. (1936) Maintenance Engr., Dept of Public Works, 18 City Hall, New Orleans, La.
- Goldberg, Abraham Norman (1933) President, A. N. Goldberg, Inc., 601 Carondelet St., New Orleans, La.
- Goldich, M. H. (1932) Surveyor, 2432 N. 32nd St., Philadelphia, Pa.
- Good, Raymond C. (1932) Surveyor, 2427 N. Cleveland Ave., Philadelphia Pa.
- Goodell, Paul Homer (Assoc.-1933) Street Lighting Engr., General Illumination Engrg. Co., 3605-07 Carew Tower, Cincinnati, Ohio.
- Goodridge, Harry (1929) City Engr. and Supt. of Streets, City Hall, Berkeley, Calif.
- Gordon, Murray (1937) Town Engr., Box 95, Truro, Nova Scotia, Can.
- Gould, Richard H. (1933) Engr., Sewage Disposal and Intercepting Sewers, Dept. Sanitation, 54 Lafayette St., New York, N. Y.
- Graddy, J. M. (1935) Supt. of Public Works, 1401 10th Ave., Columbus, Ga.
- Graham, Leland L. (1934) Director of Public Works, City Hall, Jamestown, N. Y.
- Graham, Ralph C. (1935) Supt. Construction and Public Works, City Hall, Davenport, Iowa.
- Grasser, Frank, Jr. (1930) Supt. of Streets, City Hall, Kenosha, Wis.
- Greeley, Samuel A. (1919) Greeley & Hansen, Cons. Engrs., Suite 1710, 6 N. Michigan Ave., Chicago, Ill.

- Greenawalt Engineering Company Inc.** (Assoc.-1933) 405 Lexington Ave., New York, N. Y.
- Greene, Clark M.** (1937) Supt. Public Works & Engrg., 13615 Michigan Ave., Dearborn, Mich.
- Greenlee, B. I.** (1935) Commr. of Public Works, City Hall, La Grange, Ill.
- Guillot, Albert H.** (1932) Roadway Engr., New Orleans Public Service, Inc., 1423 Adams St., New Orleans, La.
- Gulick, Luther** (1926) Director, Institute of Public Administration, 302 E. 35th St., New York, N. Y.
- Gundlach, George C.** (1931) Supt., CCC Camp, D-2 Missouri, Carrollton, Mo.
- Guyn, J. White** (1935) Construction Engr., 375 Aylesford St., Lexington, Ky.
- Haas, S. G. Frank** (1933) Technical Engr., Sewerage and Water Board, 526 Carondelet St., New Orleans, La.
- Hackett, Allen S.** (1930) Cons. Engr., 511 Whitney Bldg., New Orleans, La.
- Haddow, A. W.** (1928) City Engr., City Hall, Edmonton, Alberta, Can.
- Hadley, Henry** (1937) City Engr., City Hall, Verdun, Que., Can.
- Hafner, Ralph** (1929) Designing Traffic Draftsman, Bureau of Police, City Hall, Philadelphia, Pa.
- Haldeman, Guy K.** (1932) Asst. Engr., 1132 City Hall Annex, Philadelphia, Pa.
- Halpin, Eugene, Jr.** (1935) Commr. of Public Works, City Hall, White Plains, N. Y.
- Hamilton, Lewis C.** (1932) Asst. Engr., Dept of Public Affairs, 55 Lincoln Ave., Newark, N. J.
- Hammersley, W. P.** (1919) Supt. of Streets, Municipal Bldg., New Bedford, Mass.
- Hancock, Edwin** (1926) Cons. Municipal Engr., Edwin Hancock Engineering Co., 1509 Jackson Blvd., Chicago, Ill.
- Hansell, William A.** (Life-1916) Asst. Chief of Construction and Engr. of Sewers, 737 Woodland Ave., S. E., Atlanta, Ga.
- Hansell, William H.** (1932) Junior Surveyor, 7707 Fayette St., Philadelphia, Pa.
- Hansen, Paul** (1913) Greeley & Hansen, Suite 1700, 6 N. Michigan Ave., Chicago, Ill.
- Harris, A. Mason** (1929) Chief, Bureau of Streets, 1111 E. Broad St., Richmond, Va.
- Harris, R. C.** (1914) Commr. of Works, City Hall, Toronto, Ontario, Can.
- Hartley, G. Russell** (1936) City Engr., Municipal Bldg., Englewood, N. J.
- Hartmann, Frank J.** (1937) Director of Public Works, City Hall, Camden, N. J.
- Hasley, Thomas O.** (1935) Director of Highways, 6773 Fonvard Ave., Pittsburgh, Pa.
- Hathaway, A. S.** (1936) Asst. Prof., College of Engrg., Northwestern Univ., 1930 Sherman Ave., Evanston, Ill.
- Haulard, M. V.** (1929) Supt. Municipal Repair Plant, 4154 Therville St., New Orleans, La.

- Hawkins, A. J. (1922) Director, Alabama State Planning Bd., 321 Le Bron Ave., Montgomery, Ala.
- Hawkins, C. L. (1920) Supt., Maintenance of Way, St. Louis Public Service Co., 3869 Park Ave., St. Louis, Mo.
- Hawley, John B. (1912) Cons. Civil Engr., Hawley, Freese & Nichols, 407 Capps Bldg., Ft. Worth, Tex.
- Haydock, Winters (1927) 2117 Huidekoper Place, Washington, D. C.
- Hayes, George P., Jr. (1931) Asst. Office Engr., Pennsylvania Railroad Co., Berwyn, Pa.
- Hayes, Morgan D. (1934) City Engr., 52 City Hall, Rochester, N. Y.
- Haynes, Hugh P. (1925) City Engr., City Offices, Winfield, Kans.
- Heald, Henry Townley (1935) Dean, and Professor Civil Engrg., Armour Institute of Technology, 3300 Federal St., Chicago, Ill.
- Hebden, Norman (1936) Asst. Director, American Public Works Assn., 850 E. 58th St., Chicago, Ill.
- Hedtler, Robert S. (1931) Cons. Engr. for Aeronautics, 2506 S. Lambert St., Philadelphia, Pa.
- Heebink, G. E. (1917) Supervising Engr., Dept. of Public Works, City Offices, Beloit, Wis.
- Heideman, A. (1931) Chief Mechanical Engr., Koch Hospital, 4821 Margaretta Ave., St. Louis, Mo.
- Heil, Julius P. (Assoc.-1928) President, The Heil Company, Milwaukee, Wis.
- Heimbuecher, Walter A. (1931) City Engr., City Hall, University City, Mo.
- Helm, J. S. (Assoc.-1913) Mgr., Asphalt Sales Dept., Standard Oil Co. of N. J., 26 Broadway, New York, N. Y.
- Hempelmann, W. L. (Assoc.-1911) Engr., Asphalt Sales Dept., The Texas Co., 332 S. Michigan Ave., Chicago, Ill.
- Herberick, William L. (1931) Second Asst. Engr., Bureau of Engrg., Surveys and Zoning, 2766 Kirkbride St., Philadelphia, Pa.
- Herring, Frank W. (1935) Executive Director, American Public Works Assn., 850 E. 58th St., Chicago, Ill.
- Herron, James Herve (1935) President, The James H. Herron Co., 1360 W. 3rd St., Cleveland, Ohio.
- Herzog, Lester W. (1924) State Administrator, WPA, Old Post Office Bldg., Albany, N. Y.
- Hess, Edgar B. (1936) City Engr., Director of Public Service, 183 Plum St., Chillicothe, Ohio.
- Hess, Wenzel J. (1931) Photographer, Bureau of Highways, 1429 N. 12th St., Philadelphia, Pa.
- Hesselbacher, George E. (1934) Township Engr., 8200 Fairview Road, Elkins Park, Pa.
- Hibbard, F. Gardiner (1926) Asst. Engr. of Way and Structures, Milwaukee Electric Railway and Light Co., 423 Public Service Bldg., Milwaukee, Wis.
- Hicks, Walter F. (1932) City Engr., City Hall, Paris, Tex.
- Highland, Scotland G. (1921) General Mgr., Water Board, Clarksburg, W. Va.

- Hill, Theodore C. (1931) Hill & Hill, Engrs., 24½ E. Main St., North East, Pa.
- Hochstadter, Irving (1928) President, Stillman & Van Siclen, Inc., 254 W. 31st St., New York, N. Y.
- Hodges, Henry G. (1935) Director, Municipal Reference Bureau, City Hall, Cincinnati, Ohio.
- Hoffmann, Robert (1908) Commr of Engrg., 518 City Hall, Cleveland, Ohio.
- Hoke, John B. (1929) District Engr., Interstate Amiesite Co., Stewart Bldg., Martinsburg, W. Va.
- Hoots, Paul F. (1932) Chief Engr., Engrg. Dept., New Orleans Public Service, Inc., 317 Baronne St., New Orleans, La.
- Hopkins, Charles C. (1937) Cons. Engr., 349 Cutler Bldg., Rochester, N. Y.
- Hopkins, Elmer W. (1931) City Engr., City Hall, Salina, Kans.
- Horner, W. W. (Life-1915) Municipal and Sanitary Cons. Engr., 1312 International Office Bldg., St. Louis, Mo.
- Hornig, Philip H. (1932) First Asst. Surveyor, 6251 Magnolia St., Germantown, Philadelphia, Pa.
- Howe, Henry L. (1926) Mechanical and Electrical Engr, Civil Engr., Division of Engrg., 52 City Hall, Rochester, N. Y.
- Howell, Carl L. (1914) Asst. Engr., 502 City Hall, Buffalo, N. Y.
- Howland, Charles A. (1923) Staff Engr., Bureau of Municipal Research, 311 S. Juniper St., Philadelphia, Pa.
- Howson, L. R. (1926) Cons. Engr., Alvord, Burdick & Howson, 20 N. Wacker Drive, Chicago, Ill.
- Hubbard, Prevost (1913) Chemical Engr., Asphalt Institute, 801 Second Ave., New York, N. Y.
- Hubbel, Clarence W. (1928) Cons. Engr., 2640 Buhl Bldg., Detroit, Mich.
- Hudson, Edwin I. (1936) Alderman, 3300 38th Ave., South, Minneapolis, Minn.
- Hughes, Charles W. (1920) Cons. Engr., 2147 Fifth St., Port Arthur, Tex.
- Hughes, H. D. (1927) Mgr., American Cast Iron Pipe Co., P. O. Box 1491, Dallas, Tex.
- Hughes, H. Walter (1936) Supervisor Sect. Tests & Matls., 34 Court St., Rochester, N. Y.
- Hulick, Dan A. (1926) 408 Townes St., Greenville, S. C.
- Hunt, Edward M. (1935) Commr. of Public Works, City Engr., City Hall, Portland, Maine.
- Hunter, Percy E. (Assoc.-1931) President, Hunter Steel Co., 2300 Grand Ave., Neville Island, Pittsburgh, Pa.
- Hurley, J. Raymond (1935) Supt. Public Works, City Hall, Canandaigua, N. Y.
- Hyland, N. W. (1930) Asst. Director of Public Works, City Hall, Kansas City, Mo.
- International Harvester Company (Assoc.-1932) 606 S. Michigan Ave., Chicago, Ill.
- Ireland, C. Eugene (Assoc.-1920) President, Birmingham Slag Co., 2019 Sixth Ave., N., Birmingham, Ala.
- Jacka, S. C. (1937) City Engr., City Hall, Lansing, Mich.

- Jackson, M. D. (1937) City Engr., 213 N. 2nd St., Stevens Point, Wis.
- Jenkins, Frank L. (1936) City Engr., Municipal Bldg., Portland, Mich.
- Jennetty, Adam (1935) Street Commr., City Hall, Perth Amboy, N. J.
- Jennings, Irving C. (1929) President, Nash Engineering Co., South Norwalk, Conn.
- Johns, Walter P. (1928) City Engr., City Hall, Wilkes-Barre, Pa.
- Johnson, Andrew K. (1928) Engr. of Highways, 190-24 111th Rd., St. Albans, N. Y.
- Johnston, Elwood R. (1931) Engrg. Division, E. I. du Pont de Nemours Co. of Wilmington, Del., 5412 Hadfield St., Philadelphia, Pa.
- Johnston, Grant (1936) Gen. Foreman, WPA, 245 Sumac St., Wissahickon, Philadelphia, Pa.
- Johnston, H. W. (1937) City Engr., City Hall, Halifax, Nova Scotia, Can.
- Johnston, Leslie M. (1935) Director of Public Works, City Hall, Pittsburgh, Pa.
- Jones, Henry L. (1931) Senior Surveyor, 11th Survey District, 1317 S 56th St., Philadelphia, Pa.
- Joseph, Ben H. (1931) Senior Surveyor, 1152 E. Brill St., Philadelphia, Pa.
- Josephson, H. (1935) Inspector, City Street Dept., City Hall, South Bend, Ind.
- Kampe, Ervin (Assoc-1932) 100 Montrose Drive, South Charleston, W. Va.
- Karney, Harry T., Jr. (1932) Surveyor, 1132 Bridge St., Philadelphia, Pa.
- Kearney, John J. (1926) City Engr., 3136 Maple Ave., Berwyn, Ill.
- Keating, Charles S. (1935) Asst. City Engr., 400 City Hall, Syracuse, N. Y.
- Keefer, Clarence E. (1922) Principal Asst. to Sewerage Engr., 2030 Park Ave., Baltimore, Md.
- Kemmler, E. A. (1922) Advisory Engr., 65 Dodge Ave., Akron, Ohio.
- Kendall, Charles H. (1935) State Resident Highway Engr., Box 185, Woodville, Tex.
- Kendall, Theodore Reed (1922) Engrg. Editor, American City Magazine, 470 Fourth Ave., New York, N. Y.
- Kennedy, G. D. (1935) Business Mgr., State Highway Dept., Lansing, Mich.
- Kenney, Francis B. (1937) City Surveyor, Dept. of Highways, City Hall, Manchester, N. H.
- Kernan, Francis F. (1931) Office Engr., City Engineer's Office, University City, Mo.
- Kershaw, William H. (Assoc-1911) Mgr. Asphalt Dept., Texas Co., 135 E. 42nd St., New York, N. Y.
- Ketcham, Clarence H. (1934) Supervising Engr., Dept. of Sanitation, 54 Lafayette St., New York, N. Y.
- Killmer, Albert R. (1932) Transitman, 2828 N. Marston St., Philadelphia, Pa.
- King, Oliver L. (1929) Township Engr., Abington, Pa.
- Klorer, John (1921) Cons. & Planning Engr., Sewerage & Water Bd., 526 Carondelet St., New Orleans, La.
- Knapp, Kenneth J. (1936) Asst. Engr., 52 City Hall, Rochester, N. Y.
- Knebes, E. L. (1926) Asst. City Engr., Rm. 407 City Hall, Milwaukee, Wis.

- Knourek, William** (1934) Ward Supt., Bureau of Sts., 2437 Turner Ave., Chicago, Ill.
- Koch, O. H.** (1934) Cons. Engr., Koch & Fowler, Central State Bank Bldg., Dallas, Tex.
- Koester, Edwin F.** (1928) Survey and Traffic Engr., 414 W. 22nd St., Wilmington, Del.
- Kohler, George F.** (1929) Surveyor and Regulator, 1st Dist., 2010 Rhawn St., Philadelphia, Pa.
- Kohler, H. R.** (1937) Junior Asst. Engr., 52 City Hall, Rochester, N. Y.
- Kohler, Mervin H.** (1937) Asst. Engr., Bureau of Engrg., Surveys & Zoning, Rm. 1232 City Hall Annex, Philadelphia, Pa.
- Kohnke, R. B.** (1930) Aide to Commr. of Public Property, City Hall, New Orleans, La.
- Kopf, Herbert T.** (1937) Junior Asst. Engr., 54 Court St., Rochester, N. Y.
- Kramaroff, Richard** (1933) Mech. Draftsman, 1201 City Hall Annex, Philadelphia, Pa.
- Kramer, Raymond M.** (1931) Surveyor, 1713 Dyre St., Frankford, Philadelphia, Pa.
- Kriege, H. F.** (1930) Technical Director, France Stone Co., 1219 W. Bancroft St., Toledo, Ohio.
- Krohn, Herman** (1931) Asst. City Planning Engr., 1225 City Hall Annex, Philadelphia, Pa.
- Krupicka, Anton J.** (1937) Commr., Dept. of Public Works, 5520 W. Cermak Rd., Cicero, Ill.
- Kuhn, Robert J.** (1932) Cons. Engr., 1127 Canal Bank Bldg., New Orleans, La.
- Laboon, J. F.** (1930) Director of Works, Allegheny County, City-County Bldg., Pittsburgh, Pa.
- Lafaye, Sidney P.** (1932) Office Engr., Drainage Dept., 301 Sewerage and Water Bd. Bldg., New Orleans, La.
- Lamson, B. F.** (1925) City Engr., City Hall, St. Catharines, Ontario, Can.
- Lanahan, Frank J.** (Assoc.-1931) President, Fort Pitt Malleable Iron Co., P. O. Box 505, Pittsburgh, Pa.
- Lancaster, Gilbert** (1935) Supervisor of Incinerators, Dept. of Public Works, 2106 Fulton Ave., Cincinnati, Ohio.
- Lang, T. S.** (1925) City Engr., City Bldg., Clarksburg, W. Va.
- Laphen, Morris** (1931) District Supt., Bureau of Sts., 2840 S. Calumet Ave., Chicago, Ill.
- Latimer, Claude A.** (1936) Village Engr., 150 Spencer Place, Mamaroneck, N. Y.
- Law, Leroy M.** (1928) Asphalt Technologist, Shell Petroleum Corp., Shell Bldg., St. Louis, Mo.
- Lawler, L. D.** (1937) Asst. Engr., Dept. of Engrg., 33 Glasgow St., Rochester, N. Y.
- Lawlor, Thomas F.** (1926) Cons. Engr. and Supt. of Public Works, 140 South Cherry St., Poughkeepsie, N. Y.
- Leahy, P. J.** (1932) Deputy Commr. of Public Works, City Hall, Troy, N. Y.
- Leake, George E.** (1933) Supt. of Streets, 208 S. Racine Ave., Chicago, Ill.

- Learned, Albert P.** (1926) Asst. Engr., Black & Veatch, 4706 Broadway, Kansas City, Mo.
- Lee, Frank O.** (1935) Director of Public Works, City Hall, St. Petersburg, Fla.
- Lee, R. B.** (1918) 29 West 8th St., Hutchinson, Kans.
- Leibowitz, David** (1932) Asst. Engr., Bureau of Highways, 2491 Davidson Ave., Bronx, New York, N. Y.
- Lenhardt, Laurence G.** (1936) Commr. of Public Works, City Hall, Detroit, Mich.
- Levinson, Charles E.** (1932) Transitman, 3433 Ridge Ave., Philadelphia, Pa.
- Lewis, John V.** (1934) Director of Maintenance and Operation, Dept. of Public Works, 54 Court St., Rochester, N. Y.
- Lingley, Ralph G.** (1920) City Engr., 33 City Hall, Worcester, Mass.
- Loewe, Arthur F.** (1935) Special Repres., General Electric Co., 1405 Locust St., Philadelphia, Pa.
- Longsdorf, Paul Wright** (1929) President, Paul W. Longsdorf, Inc., Elkins Park, Pa.
- Looney, William Henry** (1935) City Engr., 232 Fourth St., Stambaugh, Mich.
- Love, H. J.** (Assoc.-1925) Mgr., National Slag Assn., 644 Earle Bldg., Washington, D. C.
- Lovett, Frank Wm.** (Assoc.-1933) Sanitary Engr., Link-Belt Co., 300 W. 39th St., Chicago, Ill.
- Lovewell, Maurice N.** (1912) Asst. Engr., Chicago Park District, 7631 Luella Ave., Chicago, Ill.
- Loving, M. W.** (Assoc.-1923) Secy., American Concrete Pipe Assn., 33 West Grand Ave., Chicago, Ill.
- Lyle, John M.** (1933) Cons. Engr., 222 S. Mariposa St., Los Angeles, Calif.
- Lynch, C. Robert** (1931) Chief, Division of Harbors and Rivers, Dept. of Public Works, State Office Bldg., Providence, R. I.
- Lyons, Robert S.** (1932) Asst. Engr., Way Dept., Philadelphia Rapid Transit Co., 5938 Chester Ave., Philadelphia, Pa.
- Macallum, Andrew F.** (Senior-1909) 108 Avenue Rd., Toronto, Ontario, Can.
- McCartt, L. E.** (1935) City Engr., City Hall, Covington, Ky.
- McDermott, Charles P.** (1929) Chief Clerk, Bureau of City Property, 117 City Hall, Philadelphia, Pa.
- McDevitt, Frank J.** (1934) Director, Streets and Sewers, City Hall, St. Louis, Mo.
- MacDonnell, Charles** (1931) Asst. Engr., 5465 Euclid Ave., Philadelphia, Pa.
- McElwain, Harold Barnard** (1937) Asst. Engr., 125 Falleson Rd., Rochester, N. Y.
- McFaul, William Lawrence** (1924) City Engr. and Mgr., Water Works, City Hall, Hamilton, Ontario, Can.
- McGlensey, William D.** (1931) 1st Asst. Surveyor, 5827 Upland Way, Philadelphia, Pa.
- McGraw-Hill Publishing Company** (Engineering News-Record) (Assoc.-1930) 330 W. 42nd St., New York, N. Y.

- McJoynt, John A.** (1935) General Mgr., Terminal Service Co., 716 First National Bank Bldg., Cincinnati, Ohio.
- McKeough, John J., Jr.** (1931) Surveyor, In Charge Municipal Construction, 5005 Linden Ave., Torresdale, Philadelphia, Pa.
- Mackie, Bert V.** (1932) Surveyor, 6961 Rodney St., Philadelphia, Pa.
- McLaughlin, Martin J.** (1928) Director, Public Works, City Hall Annex, Philadelphia, Pa.
- Maclean, Robert D.** (1933) City Engr., 36 W. State St., Niles, Ohio.
- McMahon, E. J.** (1933) Street Commr., City Hall, St. Louis, Mo.
- McMullen, George** (1937) Inspector, Dept. of Public Works, 34 Court St., Rochester, N. Y.
- McVea, J. C.** (1919) Municipal Improvement Engr., 1318 Kipling St., Houston, Tex.
- Maetzel, Paul W.** (1935) City Engr., City Hall, Columbus, Ohio.
- Mahony, J. J.** (1921) City Clerk, St. Johns, Newfoundland.
- Maier, Harry L.** (1919) Chief Engr., Street & Sewer Dept., 229 N. Connell St., Wilmington, Del.
- Mall, Ivor O.** (1929) Ebasco Service, Inc., 2 Rector St., New York, N. Y.
- Mallery, Earl D.** (1936) Mgr., Washington Office, American Municipal Assn., 730 Jackson Place, Washington, D. C.
- Manion, John R.** (1932) Supt. Waste Collection, 1342 Covedale Ave., Cincinnati, Ohio.
- Mann, Karl M.** (Assoc.-1930) President, Case-Shepperd-Mann Publishing Corp., 24 W. 40th St., New York, N. Y.
- Manosa, M.** (1929) Asst. Mgr., Metropolitan Water District, 755 Rizal Ave., Manila, P. I.
- Mansfield, Myron G.** (1933) Vice Pres and Secy., Morris Knowles, Inc., 507 Westinghouse Bldg., Pittsburgh, Pa.
- Manship, Horace H.** (1932) Principal Asst. Surveyor, Clarkson Ave. and Wister St., Philadelphia, Pa.
- Manzler, Adam T.** (1936) Secy. to Commr. of Public Works, City Hall Annex, Rochester, N. Y.
- Marker, James R.** (Senior-1907) Chief Engr., Ohio Paving Brick Mfrs. Assn., 510 Hartman Bldg., Columbus, Ohio.
- Marks, Albert E.** (1932) Asst. Civil Engr., Sewerage and Water Board, 526 Carondelet St., New Orleans, La.
- Marks, Nathaniel L., Jr.** (1936) City Engr., 21 City Hall, New Orleans, La.
- Marsh, Burton W.** (1931) Director, Safety and Traffic Engrg. Dept., Am. Automobile Assn., Pennsylvania Ave. at 17th St., Washington, D. C.
- Marston, Frank A.** (1922) Partner, Metcalf & Eddy, 1300 Statler Bldg., Boston, Mass.
- Marth, Oscar** (1936) Asst. Supervisor, Section Tests & Matls., Dept. of Public Works, 34 Court St., Rochester, N. Y.
- Martin, Carl H.** (1931) Asst. Engr., Modjeski, Masters & Case, Inc., 7331 Walnut Lane, Philadelphia, Pa.
- Martin, E. F.** (1935) City Engr., City Hall, Montclair, N. J.
- Martin, George E.** (1933) Cons. Engr., The Barrett Co., 40 Rector St., New York, N. Y.
- Martin, John L.** (1932) Engr. of Way, Philadelphia Rapid Transit Co., 131 W. Roosevelt Blvd., Philadelphia, Pa.

- Martin, Ralph F.** (1932) Surveyor, Bureau of Engrg., Surveys & Zoning 7331 Walnut Lane, Philadelphia, Pa.
- Marvin, Charles W.** (1937) Asst. Engr., 52 City Hall, Rochester, N. Y.
- Marvin, John H.** (1935) Supt., Public Works Records, Dept. of Public Works, 345 City Hall, Cincinnati, Ohio.
- Masterson, Leo J.** (1931) Asst. City Planning Engr., Bureau of Engrg Surveys and Zoning, 3608 N. 19th St., Philadelphia, Pa.
- Mastriani, Samuel G.** (1935) Cons. Engr., Dunmore & Throop Boroughs. Borough Bldg., Dunmore, Pa.
- Matson, Theodore M.** (1931) Traffic Survey, 40 First St., San Francisco, Calif.
- Matzat, Francis H.** (1937) Asst. Engr., 52 City Hall, Rochester, N. Y.
- Maxcy, Charles J.** (1935) Chief Accountant, PWA, 1629 Columbia Rd., N. W., Washington, D. C.
- Meade, Harold E.** (1932) General Sales Mgr., New Orleans Public Service, Inc., 317 Baronne St., New Orleans, La.
- Mebus, Charles F.** (1920) Cons. Engr., 112 S. Easton Road., Glenside, Pa.
- Meck, William L.** (1931) Principal Asst. Surveyor, Bureau of Engrg., Surveys and Zoning, 7926 Loretto Ave., Philadelphia, Pa.
- Meckley, E. W.** (1925) City Engr., City Hall, Allentown, Pa.
- Metz, Herbert H.** (1926) Borough Engr., 20 S. Richardson Ave., Lansdale, Pa.
- Meyers, Dudley C.** (1923) c/o Father Gibson, 117 Peoria St., Chicago, Ill.
- Mickle, D. Grant** (1935) Jensen, Bowen & Farrell, Michigan Theatre Bldg., Ann Arbor, Mich.
- Miller, C. H.** (1923) Mgr., Vitrified Dept., Laclede Christy Clay Products Co., 1711 Ambassador Bldg., St. Louis, Mo.
- Miller, David G.** (1934) Commr. of Public Works, 840 Main St., Peekskill, N. Y.
- Miller, Edwin A.** (1926) Supervisor of Maint., Dept. of Public Works, City Hall Annex, Rochester, N. Y.
- Miller, J. Strother** (Assoc. 1913) Director, Technical Bureau, The Barber Asphalt Co., Maurer, N. J.
- Miller, W. C.** (1937) City Engr. & Treas., City Hall, St. Thomas, Ontario, Can.
- Mintzer, Howard K.** (1936) Supervising Estimator, Bureau of Highways, 5312 Oxford St., West Philadelphia, Pa.
- Mitchell, Duke** (1931) Asst. City Engr., 745 Yale Ave., Webster Groves, Mo.
- Mitchell, Louis** (1935) Dean of Engrg. and Cons. Engr., Syracuse University, Syracuse, N. Y.
- Mitchell, Robert A.** (1931) Traffic Engr., Dept. of Public Safety, 790 City Hall, Philadelphia, Pa.
- Mockler, John T.** (1928) First Asst. Engr., 401 City Hall, Buffalo, N. Y.
- Moe, Gustave A.** (1928) Chief of Field Staff, Public Administration Service, 850 E. 58th St., Chicago, Ill.
- Mohr, Arthur W.** (1932) Am. Bitumuls Co., P. O. Box 1108, Baton Rouge, La.
- Mohr, John** (1935) Asst. Engr., Dept. of Sanitation, 732 Quincy Ave., Bronx, New York, N. Y.

- Monahan, James V.** (1936) Chief Engr., Public Recreation Comm., 114 City Hall, Cincinnati, Ohio.
- Mondello, Anthony G.** (Assoc.-1932) Mgr., Dependable Engrg. & Contracting Co., 156 W. Cumberland St., Philadelphia, Pa.
- Montgomery, Frank M.** (1928) Licensed Scavenger, 911 Dubuque St., Sioux City, Iowa.
- Moorhouse, John H.** (1936) Supt., Dept. of Public Service, 30 Gerald Ave., Highland Park, Mich.
- Morales, Luis** (1917) Cons. Engr., Morales & Co., Compostela, 38, Havana, Cuba.
- Morrison, Thomas J.** (1934) Commr. of Public Works, 54 Court St., Rochester, N. Y.
- Moser, Albert W.** (1931) Asst. City Planning Engr., Bureau of Engrg., Surveys and Zoning, 1103 City Hall Annex, Philadelphia, Pa.
- Moulding, Stanley W., Sr.** (1935) Mount Healthy, Ohio.
- Moulthrop, H. R.** (1936) Asst. Engr., Dept. of Public Works, 34 Pinnacle Rd., Rochester, N. Y.
- Mulryan, David E.** (1936) Asst. Engr., Dept. of Public Works, 426 Bay St., Rochester, N. Y.
- Mulvihill, Francis J.** (1928) 1028 Connecticut Ave., N. W., Washington, D. C.
- Municipal Sanitation** (Assoc.-1930) 24 West 40th St., New York, N. Y.
- Murray, Edward J.** (1934) Director of Public Works, City Hall, Yonkers, N. Y.
- Murray, Matt S.** (1926) Missouri Works Progress Administrator, 5800 Wyandotte, Kansas City, Mo.
- Mussina, Lyons** (1936) City Engr., 715 Campbell St., Williamsport, Pa.
- Myers, Ernest S.** (1932) Asst. to President, New Orleans Public Service, Inc., 317 Baronne St., New Orleans, La.
- Naquin, A. J.** (1932) Transportation Engr., New Orleans Public Service, Inc., 317 Baronne St., New Orleans, La.
- Neeson, John H.** (1925) Chief Engr. and Surveyor, Bureau of Engrg., Surveys and Zoning, 1103 City Hall Annex, Philadelphia, Pa.
- Neis, Robert E.** (1936) City Director, City Hall, Monroe, Mich.
- Nemoyer, J. W.** (1930) Asst. Engr., Greeley & Hansen, 6 N. Michigan Ave., Chicago, Ill.
- Nevin, John H.** (1931) First Asst. Engr., Bureau of Engrg., Surveys and Zoning, 1625 Cayuga St., Philadelphia, Pa.
- Nier, Edward F.** (1936) Chief Clerk, Commr.'s. Office, 54 Court St., Rochester, N. Y.
- Nilles, Philip C.** (1932) Supt. of Equipment, Bureau of Streets, 2324 S. Ashland Ave., Chicago, Ill.
- Noack, Arthur** (1926) Supervisor, New Jersey Geodetic Control Survey, 60 Outwater Lane, Garfield, N. J.
- Norton, James G.** (1934) City Engr., City Hall, Kingston, N. Y.
- Nosky, Richard F.** (1937) City Engr., City Hall, North Platte, Nebr.
- Nowlan, Hume K.** (1935) Exec. Secy., West Virginia League of Municipalities, Box 427, Charleston, W. Va.
- Nunlist, H. A.** (Assoc.-1935) President, J. A. Stewart Engrg. Co., 1011 Traction Bldg., Cincinnati, Ohio.

- Nutting, H. C. (1919) President, The H. C. Nutting Co., 4120 Davis Lane, Cincinnati, Ohio.
- Nye, George H. (1925) City Engr., 302 Municipal Bldg., New Bedford, Mass.
- Nygard, Carl O. (1929) Supt. of Incineration, Riverside Destructor, 28th and Pacific St., Minneapolis, Minn.
- O'Brien, D. F. (1930) Alderman, 1218 University Ave., N E., Minneapolis, Minn.
- Ogden, W. H. H., Jr. (1929) Surveyor and Regulator, 3rd District, 1129 City Hall Annex, Philadelphia, Pa.
- Ohrt, Frederick (1935) Mgr. and Chief Engr., Bd. of Water Supply, P. O. Box 3347, Honolulu, T. H.
- Older, Clifford (1925) 1026 Elmwood Ave., Wilmette, Ill.
- Older, T. Fred (1936) Mgr. of Public Utilities, 125 W. Michigan Ave., Ypsilanti, Mich.
- Oliver, Elmer L. (1936) Asst. Engr., Dept. of Public Works, 52 City Hall, Rochester, N. Y.
- Olmsted, Frederick L. (1909) Landscape Architect, Olmsted Bros., 99 Warren St., Brookline, Mass.
- Olsen, William C. (1923) Cons. Engr., P. O. Box 1114, Raleigh, N. C.
- Olson, Herbert A. (1936) Michigan Municipal League, 205 S. State St., Ann Arbor, Mich.
- O'Reilly, Andrew J. (1931) Public Safety Engr., 2207 S. Grand Blvd., St. Louis, Mo.
- Orput, Raymond A. (1935) City Engr., City Hall, Rockford, Ill.
- Ortega-Rosado, Enrique (1932) Supt. of Public Works, Dept. of Interior, San Juan, Porto Rico.
- Ostrander, V. L. (1929) Sales Engr., Shell Eastern Petroleum Products, Inc., Asphalt Division, 100 State St., Albany, N. Y.
- Outzen, A. N. (1926) 9936 Cascade Ave., Detroit, Mich.
- Owen, Mark B. (1928) Vice President, Nichols Engrg. & Research Corp. of New York, 7752 Kentucky Ave., Dearborn, Mich.
- Paffrath, Ernest H. (1929) Asst. Sewer Commr., 2322 Clark Ave., St. Louis, Mo.
- Palmer, Charles W. (1932) Asst. Engr., Design Division, Dept. of City Transit, 2213 North Broad St., Germantown, Philadelphia, Pa.
- Palmer, I. Charles (1931) Division Engr., Division of Sewers, 423 City-County Bldg., Pittsburgh, Pa.
- Pardon, W. W. (1935) District Engr., State Highway Dept., Winchester, Ky.
- Parent, Arthur (Senior-1905) Consultant to City Electrical Dept., 4935 Queen Mary Road, Montreal, Quebec, Can.
- Paterson, A. B. (1929) President, New Orleans Public Service, Inc., 317 Baronne St., New Orleans, La.
- Patzig, Monroe L. (1918) Cons. Engr. and Mgr., Patzig Testing Laboratories, 2215 Ingersoll Ave., Des Moines, Iowa.
- Paul, Frederick T. (1930) City Engr., 203 City Hall, Minneapolis, Minn.
- Paulson, D. O. (Assoc.-1921) President, Municipal Supply Co., 208 S. Main St., South Bend, Ind.

- Pearse, Langdon (1919) Sanitary Engr., Sanitary Dist. of Chicago, 910 S. Michigan Ave., Chicago, Ill.
- Pearson, Thomas (1934) Dept. of Sanitation, Municipal Bldg., New York, N. Y.
- Pease, Fred A. (1926) President, F. A. Pease Engrg. Co., 1211 Terminal Tower, Cleveland, Ohio.
- Peck, Leon F. (1913) Supt. of Streets, Municipal Bldg., Hartford, Conn.
- Peirce, Walter A. (1936) Mgr., Water Dept., City Hall, Racine, Wis.
- Pennybacker, J. E. (Assoc.-1919) Managing Director, The Asphalt Institute, 801 Second Ave., New York, N. Y.
- Perkins, G. Howard (Senior-1905) Secy., Warren Bros. Co., P. O. Box 1869, Boston, Mass.
- Perkins, William C. (Senior-1907) Chief Engr., Eastern Paving Brick Assn., Langhorne, Pa.
- Perrine, J. Franklin (1921) Engr. of Sewers, Borough of Queens, Borough Hall, Long Island City, N. Y.
- Perring, Henry G. (1921) Architect and Engr., 10 W. Chase St., Baltimore, Md.
- Phillips, James H. (1931) Chief Engr., Essex County Park Comm., 115 Clifton Ave., Newark, N. J.
- Phillips, Cornelius W. (1933) Supt., Dept. of Sts. and Engrg., 36 Court St., Springfield, Mass.
- Phillips, James, Jr. (1934) Supt., Incineration, P. O. Box 4, Yonkers, N. Y.
- Phillips, Roy L. (1918) City Engr., City Bldg., Meadville, Pa.
- Piatt, William M. (1926) Cons. Engr., 400 Depositors' Natl. Bank Bldg., Durham, N. C.
- Pierson, Frank W. (1915) Street Commr., Street and Sewer Dept., City Hall, Wilmington, Del.
- Pinel, Stanley I. (1936) Prin. Engr., Municipal Research & Service, City Hall, Louisville, Ky.
- Pinker, George W. (1932) Supt., Bureau of Street Cleaning, 5328 N. Camac St., Philadelphia, Pa.
- Pittsburgh-Des Moines Steel Company (Assoc.-1930) Neville Station, Pittsburgh, Pa.
- Polk, Wesley W. (1936) Supt. & Chief Engr., Water Dept., Sheridan & Lincoln Sts., Evanston, Ill.
- Pollock, Clarence D. (Senior-1902) Cons. Engr., 1716 Park Row Bldg., New York, N. Y.
- Pollock, James R. (1935) Director of Public Works & Utilities, City Hall, Flint, Mich.
- Poole, C. Arthur (1918) Resident Engr.-Inspector, PWA, Jefferson Apts., Jefferson and 3rd St., Niagara Falls, N. Y.
- Porter, John Francis (1935) Supt. Property Maintenance, Dept. of Public Works, City Hall, Cincinnati, Ohio.
- Post, Ruden W. (1937) Supt. St. Lighting, 34 Court St., Rochester, N. Y.
- Potter, Alexander (1922) Cons. Sanitary & Hydraulic Engr., 50 Church St., New York, N. Y.
- Powell, John M. (1922) City Engr., City Hall, Elyria, Ohio.
- Prince, Elmer W. (1935) City Mgr. and Engr., City Hall, Morgantown, W. Va.

- Quinlan, Patrick H. (1932) Drainage Engr., Sewerage & Water Board, 526 Carondelet St., New Orleans, La.
- Quirk, J. Henry (1937) City Engr., City Hall, Bradford, Pa.
- Raffety, J. S. (1936) Sewer Engr., U. S. Resettlement Administration, 3414 Oakview Place, Cincinnati, Ohio.
- Ragsdale, Russell W. (1932) Resident Engr. Inspector, PWA, Arnett, Okla.
- Rainville, Walter S., Jr. (Assoc.-1932) Railway Dept., New Orleans Public Service, Inc., 317 Baronne St., New Orleans, La.
- Raisch, William (1926) Vice-Pres., Municipal Sanitary Service Corp., 6945 Manse St., Forest Hills, Long Island, N. Y.
- Rambo, Nathan H., Jr. (1932) Supt. of Maintenance, Bureau of City Property, 117 City Hall, Philadelphia, Pa.
- Rangel, L. A. de Souza (1936) Dept. of Engrg., Rua Buenos Ayres, No. 93-3 Andar, Rio de Janeiro, Brazil.
- Rankin, E. S. (Senior-1903) Division Engr., Division of Sewers, City Hall, Newark, N. J.
- Raymond, Nelson I. (1936) 610 Pine St., Owosso, Mich.
- Reeder, William Chester (1929) Surveyor and Regulator, 2nd District, 1312 S. 57th St., Philadelphia, Pa.
- Reid, John W. (1922) Cons. Engr., 317 Richton Ave., Highland Park, Mich.
- Reid, Kirk M. (Assoc.-1923) Illuminating Engr., Nela Park Engrg. Dept., General Electric Co., Cleveland, Ohio.
- Reidenbach, Fred W. (1936) Asst. Engr., 11 Leander Rd., Rochester, N. Y.
- Reilly, James L. (1926) Deputy Commr. of Public Works, 18 City Hall, New Orleans, La.
- Reinheimer, Joseph Peter (1936) County San. Engr. & Asst. City Engr., 240 E. McCreight Ave., Springfield, Ohio.
- Renard, Eugene Charles (1931) Res. Engr. Inspector, PWA, Buder Bldg., St. Louis, Mo.
- Reppert, Charles M. (1921) Cons. Engr., 724 S. Negley Ave., Pittsburgh, Pa.
- Requardt, G. J. (Life-1921) Cons. Engr., Whitman, Requardt & Smith, Biddle St. at Charles, Baltimore, Md.
- Rhodes, Arthur J. (1932) Geary County Engr., Box 125, Manhattan, Kans.
- Rice, John M. (1918) Cons. Engr., 2502 Grant Bldg., Pittsburgh, Pa.
- Richards, Arthur (1928) Exec. Director, Village Hall, Larchmont, N. Y.
- Richter, Louis (Assoc.-1935) President, The Richter Transfer Co., 1249 West 7th St., Cincinnati, Ohio.
- Ridgway, Robert (Senior-1902) Cons. Engr., 24 Gramercy Park, New York, N. Y.
- Ridley, Clarence E. (1919) Executive Director, The International City Managers Assn., 850 E. 58th St., Chicago, Ill.
- Riehl, W. H. (1928) City Engr., City Hall, Stratford, Ontario, Can.
- Rigsby, R. W. (1935) Asst. Executive Officer, Farm Credit Administration, 1300 E St. N. W., Washington, D. C.
- Roberts, W. H. (1937) Asst. Engr., Dept. of Public Works, 230 City Hall Annex, Rochester, N. Y.

- Robertson, Russel A. (1933) Structural Draftsman, 1240 Sanger St., Philadelphia, Pa.
- Robinson, David L., Jr. (1935) Asst. to Director, Cons. & Research Division, Public Administration Service, 850 E. 58th St., Chicago, Ill.
- Robinson, G. G. (Assoc.-1926) General Mgr., Standard Paving & Materials, Ltd., 402 Harbor Bldg., Fleet St., Toronto, Ontario, Can.
- Robinson, John H. (1932) Surveyor, 451 Seville St., Philadelphia, Pa.
- Roche, Alfred E. (1931) Division Engr., WPA, 1604 Peoples Ave., Troy, N. Y.
- Root, A. H. (1935) Works Director, Court House, Newport, Ky.
- Root, J. Eugene (1932) Director of Public Works, 104 City Hall, Cincinnati, Ohio.
- Roquemore, Bruce (1935) City Engr., City Hall, Lakeland, Fla.
- Rosen, Milton (1931) Commr. of Public Works & Corporate Secy., Minneapolis-St. Paul Sanitary District, City Hall, St. Paul, Minn.
- Rosenberg, Joseph H. (1932) Second Asst. Surveyor, Bureau of Engrg. Surveys and Zoning, 1223 City Hall Annex, Philadelphia, Pa.
- Rosengarten, Walter E. (1929) Lower Merion Township Engr., Township Bldg., Ardmore, Pa.
- Ross, Emerson (1935) Director, Division of Research, Statistics & Records, WPA, 1734 New York Ave., Washington, D. C.
- Rouse, Raymond J. (1935) Supervisor of Equipment, Dept. of Public Works, City Hall, Cincinnati, Ohio.
- Rowe, Ernest J. (1931) Supt., Water and Light Dept., 110 Maple Ave., Wellsville, N. Y.
- Rowe, Frank (1937) Supt. of Motor Equipment of Public Works, 531 Frost Ave., Rochester, N. Y.
- Rush, Benjamin F. (1933) City and County Engr., City Hall, Honolulu, T. H.
- Ryder, Ely M. T. (1922) Way Engr., Third Ave. Railway Co., 2396 Third Ave., New York, N. Y.
- Samenfink, Herman J. (1937) Supt. of Ash & Rubbish Collection, Dept. of Public Works, 54 Court St., Rochester, N. Y.
- Sammelmann, C. W. S. (Life-1915) Secy-Mgr. Engineer's Club of St. Louis, 4359 Lindell Blvd., St. Louis, Mo.
- Samuel, T. D., Jr. (1930) Chief Engr. and Supt., Water Dept., 442 W. 68th St., Kansas City, Mo.
- Sanborn, George H. (1936) Deputy Commr., Public Works, 315 DeForest Road, Syracuse, N. Y.
- Sandenburgh, George H. (1923) City Engr., City Hall, Ann Arbor, Mich.
- Sauer, Anthony M. (1935) Supt. of City Works, 3208 Colerain Ave., Cincinnati, Ohio.
- Sauer, August (1932) Resident Engr. Inspector, PWA, 412 Trenton Ave., San Antonio, Tex.
- Saville, Thorndike (1935) Assoc. Dean and Prof. of Hydraulic Sanitary Engrg., New York University, Box 65, University Heights, New York, N. Y.
- Schafmayer, A. J. (1936) Engr. Bd. of Local Improvements, 207 City Hall, Chicago, Ill.

- Schaut, George G.** (1932) Chief Chemist, Philadelphia Water Bureau, Belmont Ave. and Ford Rd., Philadelphia, Pa.
- Scheffel, John H.** (1937) Junior Asst. Engr., Dept. of Public Works, 52 City Hall, Rochester, N. Y.
- Schlenz, Harry E.** (Assoc.-1915) Vice-Pres. and Sales Mgr., Pacific Flush-Tank Co., 4241 Ravenswood Ave., Chicago, Ill.
- Schlesinger, George F.** (Senior-1907) Chief Engr. and Managing Director, National Paving Brick Assn., National Press Bldg., Washington, D. C.
- Schmuhl, William B.** (1932) Director, WPA, 221 Cherry St., Toledo, Ohio.
- Schneider, Carl** (1926) Senior Engr., WPA, 1734 New York Ave., Washington, D. C.
- Schneider, Louis** (1932) Surveyor, Bureau of Engrg., Surveys and Zoning, 2010 Rhawn St., Philadelphia, Pa.
- Schofield, Edwin R.** (1932) Division Engr., Bureau of Engrg., Surveys and Zoning, 616 E. Leverington Ave., Philadelphia, Pa.
- Schreiner, W. R.** (1926) Chemist, 46 Garfield, Glens Falls, N. Y.
- Schroeder, A.** (Honorary-1935) Weidenbornstrasse 40, Frankfurt-am-Main, Germany.
- Schroeder, Albert** (1936) City Engr., City Bldg., Piqua, Ohio.
- Schusler, George W.** (1934) Supt. Engr., Bureau of Sanitation, 604 City-County Bldg., Pittsburgh, Pa.
- Schuyler, Wm. B.** (1932) Engr., Board of Public Education, 6343 Greene St., Philadelphia, Pa.
- Schwada, Joseph P.** (1924) City Engr., City Hall, Milwaukee, Wis.
- Scott, Robert G.** (Assoc-1937) Cons. Engr., Clay Products Assn., 111 W. Washington St., Chicago, Ill.
- Setzer, Hubert K.** (1935) Director of Public Works, P. O. Box 574, Hickory, N. C.
- Shafer, Howard M.** (1937) Airport Mgr., Dept. of Public Works, 34 Court St., Rochester, N. Y.
- Shafer, William B.** (1934) Supt. of Highways and Sewers, City-County Bldg., Pittsburgh, Pa.
- Sharples, Philip P.** (1923) Cons. Engr., 17 Farrar St., Cambridge, Mass.
- Shaughnessy, Charles S.** (1932) Chief Examiner, Civil Service Comm., 975 City Hall, Philadelphia, Pa.
- Shaw, George A.** (1937) Borough Engr., 223 Delafield Ave., Aspinwall, Pa.
- Shaw, Walter A.** (1922) Cons. Engr., 30 N. LaSalle St., Chicago, Ill.
- Sheddan, W. E.** (1931) City Engr., City Engineers Bldg., Jacksonville, Fla.
- Shegog, George T.** (1929) Surveyor and Regulator, 11th District, 7 S. 40th St., Philadelphia, Pa.
- Shelly, H. T.** (Assoc.-1920) Milford, N. J.
- Shepard, George M.** (1934) Chief Engr., Dept. of Public Works, 234 City Hall, St. Paul, Minn.
- Sheppard, H. W.** (1935) Public Accountant, P. O. Box 2340, Orlando, Fla.
- Sheridan, Christopher J.** (1934) City Engr., 74 Briggs Ave., Yonkers, N. Y.
- Shifrin, Hymen** (Life-1922) Cons. Engr., 1312 International Office Bldg., St. Louis, Mo.
- Shisler, John A.** (1936) City Civil Engr., City Hall, Canton, Ohio.

- Siegrist, George Utzy** (1934) Deputy Chief, Bureau of Bldg. Inspection, 3840 N. Park Ave., Philadelphia, Pa.
- Silliman, Joseph Warren** (1932) 627 Locust Ave., Germantown, Philadelphia, Pa.
- Silva Freire, Victor da** (1922) President, Humus Ltd., Sewerage & Sanitary Developments, Caixa 18, Sao Paulo, Brazil.
- Simons, George W., Jr.** (1922) Cons. Municipal Engr., Hildebrandt Bldg., Jacksonville, Fla.
- Singer, Joseph** (1932) First Asst. Surveyor, 1529 N. Felton St., Philadelphia, Pa.
- Skelly, Joseph P.** (1930) Commr. of Public Property, City Hall, New Orleans, La.
- Skidmore, Hugh W.** (1921) Pres., Chicago Testing Lab., Inc., 536 Lake Shore Drive, Chicago, Ill.
- Skinner, John F.** (1921) Cons. Engr., 3333 W. 4th St., Los Angeles, Calif.
- Smith, Benjamin Le Compte** (1922) Cons. Engr., Whitman, Requardt & Smith, West Biddle St. at Charles, Baltimore, Md.
- Smith, Leon A.** (1930) Supt., Water Works, City Hall, Madison, Wis.
- Smith, Meloy** (1937) Supt. of Water, 16 State St., Rochester, N. Y.
- Smith, Nathan L.** (1937) Chief Engr., State Roads Comm., Federal Reserve Bank Bldg., Baltimore, Md.
- Smith, Robert M.** (1926) City Engr. and Director of Public Works, City Hall, Kenosha, Wis.
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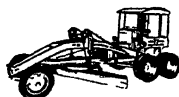


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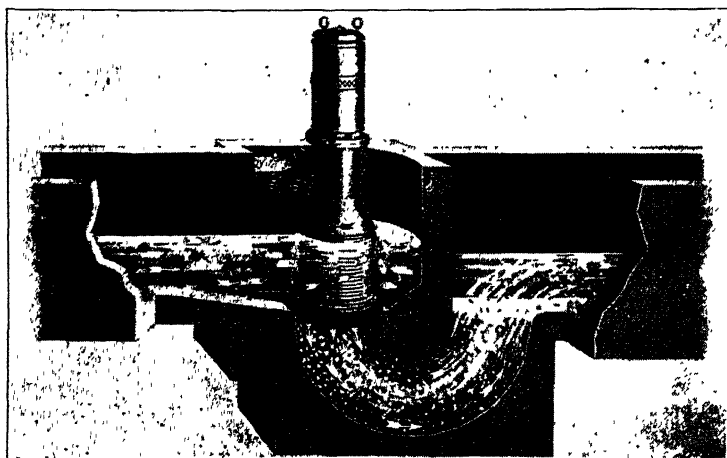
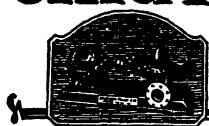


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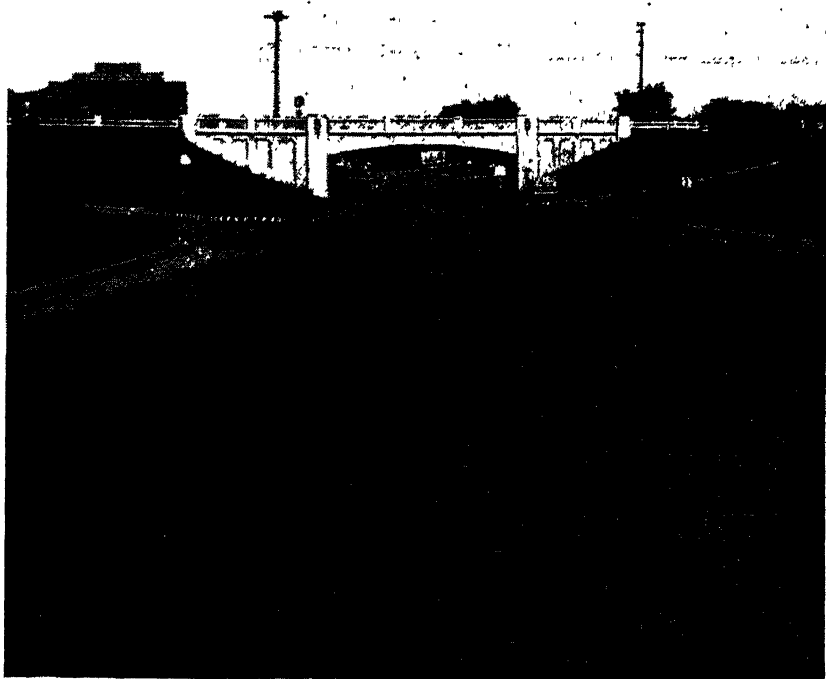
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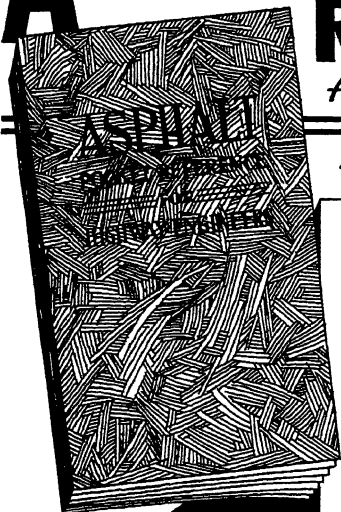
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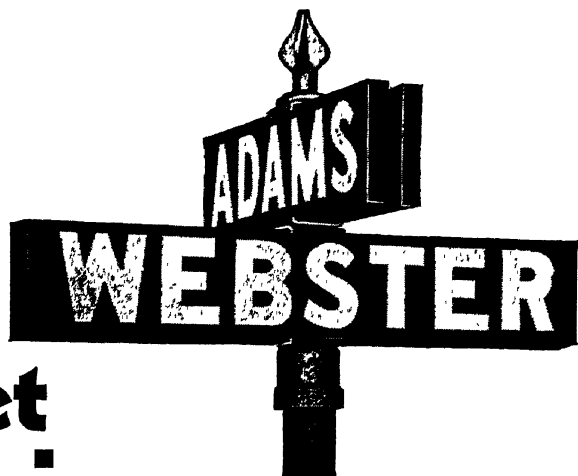
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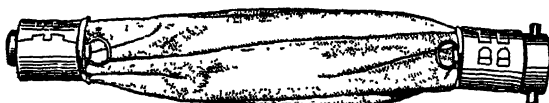
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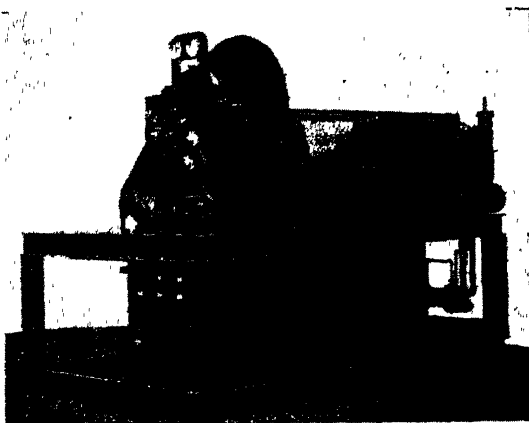
The vast expenditures for concrete sewers of all sizes are the natural result of the performance of these early pipe lines. The Sanitary District of Chicago alone has expended more than \$42,000,000 for concrete sanitary sewers; Detroit, Mich., more than \$60,000,000, including concrete pipe lateral sewers. Louisville, Ky., is completing a \$17,000,000 concrete sewerage system today. The River Des Peres sewers in St. Louis, 29 and 32 ft. in diameter, which cost more than \$11,000,000 were built with concrete; Baltimore's 7-mile, 12-ft. outfall concrete sanitary sewer was built in 1908 and placed in service in 1911. When examined in 1931, after 20 years of service, the concrete was stronger than when built (*Engineering News-Record*, May 19, 1932).

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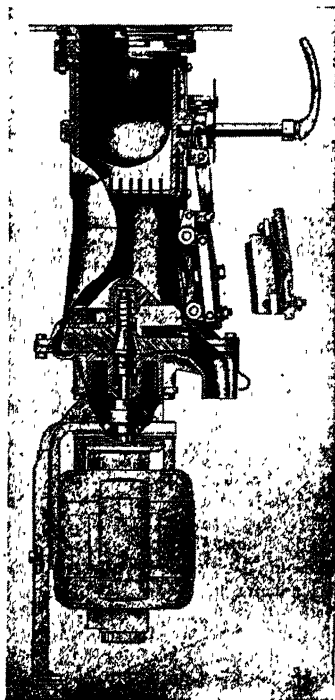
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